ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

Vol. 11 No. 16. WEEKLY. NEW YORK, SATURDAY, DECEMBER 17, 1887. $3 per annum. Single Copies, 6 Cents.

Copyright, 1887, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

Bernardo's Method of Electric Welding.

BY DR. R. RUHLMANN, IN LONDON ELECTRICIAN.

When the author first saw Dr. Bernardo's method in use at St. Petersburg, he was involuntarily reminded of Columbus and the egg. It has been well known for many years that almost all substances were readily fusible in the electric arc, and Siemens, Wallner, Cowles and others have done much work in the direction of electrical welding by this means, with more or less success. The principal point in which Bernardo differs from his predecessors is that he makes the metal to be welded *itself the negative pole*, the positive being a carbon rod. The strong reducing action thus brought to bear on the metal keeps it perfectly clean and unoxidized. If the poles are reversed, the fluid metal is promptly covered with a layer of oxide, which makes the welding almost impossible; and there is also great danger of burning holes. Bernardo uses as a source of current, seven sets of accumulators in parallel, each set 70 cells in series. These he charges continually while working by a shunt dynamo giving 120 amperes at 175 volts. He uses special battery plates made of lead strip, as he has found that "pasted" cells will not stand the very heavy charge and discharge currents he employs. Messrs. Rothschild had great trouble at Creil from using "pasted" plates.

The E. M. F. and current required depend on the size, etc., of the work to be done. As an example, to weld together two pieces of $\frac{3}{8}$ inch boiler plate, 40 cells in series and three

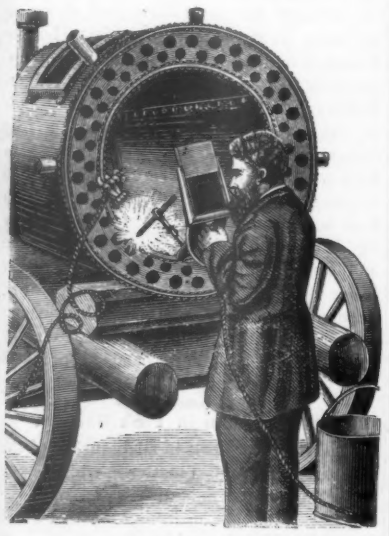


FIG. 1.

in parallel would be taken, one end joined to the plates, and the other by a flexible lead to a one-inch carbon rod in a portable holder. The metal is then touched with the rod, which is immediately withdrawn from a quarter to half an inch, thus striking an arc. The metal at the point where the arc forms melts immediately, like so much wax, and runs perfectly fluid. Through the dark spectacles the arc appears like a blow-pipe flame, and is manipulated much as if it were one. If the effect is too strong, and the metal boils and evaporates, fewer cells in parallel are used; if the arc goes out too often, more are added in series.

If heavy pieces of metal of high melting point are to be joined, large currents and E. M. F. must be used, the carbons being proportionately larger, and *vice versa*. The action of the arc is, like that of a blow-pipe flame, very local; only that part of the metal which requires to be melted is much heated, and the moment the arc is removed, the fluid metal solidifies.

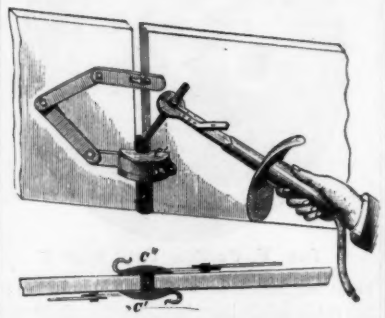


FIG. 2.

The most refractory metals are instantly liquefied and the work can be done with great rapidity.

The metals to be operated on require hardly any previous preparation, as with the high E. M. F. and currents used even a heavy coating of rust is at once fused. A little sand is used to unite with any oxide not reduced, and the slag thus formed protects the finished part from the oxygen of the air while cooling.

It is a great advantage in Bernardo's method over ordinary welding that the heat can be so easily taken to the place required, instead of having to bring the metal to the forge. Fig. 1 is from a photograph taken when repairing a boiler, and is a good example of the extreme simplicity and convenience of the method. The negative lead is attached to any part of the boiler by the small vise on the left, and then by taking the positive carbon-holder in the hand, any part of the boiler can be operated on.

Besides welding two pieces of steel,

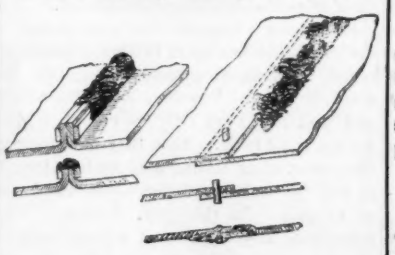


FIG. 3.

wrought or cast iron, etc., together, the process has been used to join iron with copper, tin, zinc, brass, lead, steel, or cast iron with perfect success, as also to weld copper and brass, brass and brass, etc., and to coat iron with copper, tin, and lead. It may also be used to cut up as well as join a piece of iron plate, etc., as the melted metal runs off like water if no means are taken to retain it; and it may be noted that the process may even be used under water both for welding and for cutting metals.

Since the action is so rapid, and the metal so quickly cooled after welding by conduction to the surrounding parts, there is no time for any appreciable chemical action to take place, as the following analysis shows:

	Steel.		Iron.	
	Unworked.	Melted.	Unworked.	Melted.
Iron	98.86	99.89	98.90	99.43
Carbon	.48	.25	.34	.14
Silicium	.04	Traces	Traces.	Traces.
Manganese	.5	.25	.50	.23
Sulphur	.04	.04	.14	.09
Phosphorus	.08	.07	.12	.11
	100.00	100.00	100.00	100.00

The "melted" columns are analyses of pieces obtained by allowing the fluid metal to run off under the arc instead of retaining it in place. A further advantage of joining metals electrically, is that nothing of the nature of a solder with different chemical and physical properties to the metals treated is employed, and that the joint is extremely little, if at all weaker, than the original unworked metal.

Fig. 2 shows the method for joining two upright plates. C' C' are carbon blocks to keep the fluid metal in, and are shifted up from time to time as the joint is made.

Fig. 3 shows pairs of plates in process of being electrically riveted.

Fig. 4 shows two pieces of a thick iron rod being joined, a carbon block being used to retain the molten metal.

Among other uses may be mentioned that of welding fine steel on to a cast iron body for

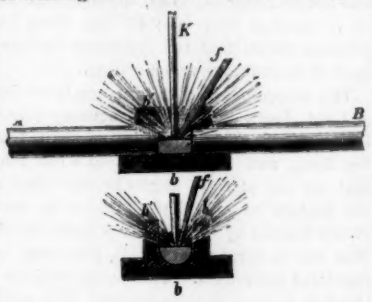


FIG. 4.

tools, etc., without any risk of the steel being burnt, and for filling up blow-holes which may only have been discovered after a considerable amount of work has been done on a piece of metal.

Electricity for the Lighted Buoys.

Lieut. Millis, who is in command of the Third District Light House Department Yard, with his headquarters at the Government yard at Tompkinsville, S. I., is now engaged in experimenting in the placing of small electric lights on top of all the lighted spar buoys in the bay. He has signed a contract for the delivery, at the Government yard at Tompkinsville, of over 2,000 feet of submarine cable, which will run from the yard to buoy No. 18, near Robbin's Reef light house, in the upper bay. The experiments have proved quite successful. Lieut. Millis said that a thirty candle power incandescent light would be put upon a buoy, and would be easily distinguishable from other lights.

Electricity as a Source of Heat.

It will be remembered that we described, in a recent issue, the new electric heater of Dr. W. Leigh Burton, of Richmond, Va. Recently four of these heaters were sent to Mr. Edward H. Johnson, president of the Edison Company, who gave them a trial at his Greenwich (Conn.) home. They were placed in a summer room adjoining his residence, where no provisions had been made for heating, and, when tested and changed somewhat easily kept the room comfortably warm. The temperature outside was about 50, while in the room the heaters brought it up to 70 and higher. The consumption of electric current was too large for the heater, in its present stage, to be considered economical, yet it greatly pleased Mr. Johnson, who informed a REVIEW representative that he intended to have further experiments made, with the view of bringing the heater within the range of practical use.

"I had no difficulty in cooking eggs, oysters, and other similar articles," said Mr. Johnson, "and, after making all these tests, confess to a confidence in the final successful extension of electricity into the domain of heating, and were I building a new house, to correspond with some of the magnificent residences of New York city, I would do away with the coal bin, which makes more or less of a factory of the residence basement, and depend on the electric current to furnish light and heat and power"

"And," remarked the REVIEWITE, "on leaving your house, if you could jump on the electric railway—the cars heated by electricity—and ride to your place of business, there using your telephone, telegraph and phonograph with its electric motor, for transacting your business, there would not seem to be many requirements of life that electricity did not fill."

"Yes," was the reply; "but I speak now of the interior of the residence, and electricity's field in it; what you say relates to the outside. It is a fact that, running through all the literature, contracts, etc., of our company, the words 'light, heat and power' have always been used, but heretofore 'heat' has not possessed much weight. That I think these experiments have proven the value of the electric heater, you will appreciate when I say that, at the meetings of the directors of our Boston company and New York company to-day, I called attention to what had been done in this direction, with a view to getting ready for its introduction."

The Burton heater, as at present constructed, consists of fine wire reflexed on an insulated base, having the necessary terminals, the wire being covered with fire clay. This arrangement caused to be given off, as heat, that which, in the incandescent lamp, radiates as light, the clay acting as a protection to the heated wire. German silver or platinum wire has generally been used.

He Hoped His Telephone Would Be "Out of Order."

Husband (who has a little "engagement" on hand)—I shall be at the office very late to-night, my dear, posting my books, and you had better not sit up for me.

Wife—Very well, John. When I get ready to go to bed, I'll just say good night to you through the telephone.

Two Miles Under the Sea.

HOW THE STEAMER MINIA LIFTS A CABLE FROM THE OCEAN'S BED.

One of the marine novelties of the world that on rare occasions comes into this port is now lying at a dock in the Erie Basin. The novelty is the steamship Minia, Capt Samuel Trott, a vessel built and used for making repairs to the Atlantic telegraph cables belonging to the combination under the control of the leading men in the Western Union Telegraph Company. To a spectator on the deck the Minia would scarcely attract attention as a marine novelty. She is neither large nor small, her length being 3.285 feet, breadth, 35.3, and depth 25.1. She is rigged as a topsail schooner, and she measures 1,986 tons gross The one feature likely to attract the eye from the deck is the appearance of three big grooved iron wheels, side by side, just where the bowsprit projects from ordinary ships. A look about the deck and down some of the hatches, however, shows a number of peculiarities.

The New York *Sun* says the Minia came here about four weeks ago, in order that she might repair certain injuries received about the rudder when engaged off the banks of Newfoundland in repairing a break in the Brest St. Pierre Line of the Anglo-American cable. The damage to the vessel was inconsiderable, for she was able to finish the repairs to the cable before coming here, but the details of the work of picking up the ends of a broken cable and splicing in a new piece, as related by one of the officers of the ship, are interesting. To one not familiar with the work, the sending of a ship to pick up the end of an inch wire rope 13,000 feet beneath the surface of the sea seems very much like a wild-goose chase, but once the plans are understood it is simple enough, though somewhat tedious at times, not only to find the ends, but to pick them up and splice them to a new piece.

The break which the Minia was sent to repair occurred early last summer. The officers of the company first located the distance of the break from the stations on shore on each side of the ocean. The details of the instrument by which this is done are not easily described, though easily understood in principle. The machine consists of a series of coils of wire, which offer a known resistance to the electric current. Enough of the coils are connected to make a resistance equal to the resistance offered by the entire cable when it is in working order, and thus when the machine and the cable are connected a balance is effected. But if the cable should break, the balance is destroyed, because that portion of the cable between the shore station and the break, wherever it may be, will offer less resistance to the electric current than the entire cable would do. Enough coils of wire are therefore disconnected from the machine to restore the balance. The resistance of the part of the cable that remains intact is thus accurately determined by the number of coils remaining connected with the machine. Having, when the cable was intact, learned the resistance which a mile of the cable offers by dividing the entire resistance by the number of miles of cable, it is easy to find how many miles of cable are still in good order by dividing the entire resistance of the piece by the known resistance of one mile.

This explanation may be a little complicated to one not fond of mathematical demonstrations, but it is just as the Minia's officer made it, and it is remarkable for its lucidity when compared with explanations which electricians generally make. It is noticeable also from the fact that the word "ohm," the name of a unit of electrical energy, and the bugbear of everyone who does not know anything about electricity, is wholly omitted.

Having determined how many miles from the shore station the break is, orders are sent to the Minia to go to the place, pick up the ends, and splice them to a new piece. Having received such an order and acted on it, Capt Trott found himself and his ship, on July 25th last, in latitude 42° 30′ north, and longitude 46° 30′ west, or just to the eastward of the Grand Banks of Newfoundland, with one of the hardest jobs before him that he had had in some time; for sounding showed that the water was about 13 000 feet, or a good deal more than two miles, deep. He knew he was somewhere near the break in the cable, but he did not know absolutely within about three or four miles, because while he had been able to determine his own position by repeated observations of the sun and stars, he could not tell how accurate the observations of the officers of the ship laying the cable had been.

The first work done was to get a series of soundings over a patch of the sea, aggregating 25 or 30 square miles. The sounding apparatus consisted of an oblong shot of iron, weighing about 32 pounds, attached to a pianoforte wire in such a way that when lowered to the bottom the shot would jab a small steel tube into the mud down there, and would then release itself from the wire and allow the sailors to draw up the tube with the mud in it. The moment the weight was released, the men on deck stopped paying out the wire, and thus, knowing how much wire had been run out, they were able to tell the depth. It is an interesting fact that it took 24 minutes and 10 seconds for the weight of the sounding apparatus to reach bottom in 2.097 fathoms of water.

Having learned the depth of water and the character of the bottom, a big black pear-shaped buoy was put overboard and moored about where the end of the broken section ought to have been, according to the calculations. The buoy is made of boiler iron and is arranged to support two large white lanterns at night, for the work is carried on day and night, when the weather will permit. This buoy is kept from floating away with the tide, by an anchor that looks like an open umbrella Secured to the anchor which was put over was a 45-fathom section of chain; above that 510 fathoms of patent rope, invented by Capt. Trott, and consisting of part steel wire and part hemp strands. It is designed for both strength and buoyancy. Then came 1,101 fathoms of pure manila rope, and above that enough of mixed wire and fiber rope of different kinds to reach the surface and secure the buoy.

The ship was now ready to begin the search proper for the cable. She was run off at right angles to the line of the cable for a distance of five miles, and a buoy got down to mark the limits of the territory to be grappled over in that direction. Buoys were afterward set elsewhere to mark the other limits of the territory. The grappling iron was lowered over the bows, the rope attached to it passing over one of the three big grooved wheels that revolve where the bowsprit of an ordinary vessel stands.

The grappling iron used is the invention of Capt. Trott. It looks something like a four-pronged anchor. It has a shaft four feet long, and four arms about a foot long that are set at right angles to each other at the bottom of the shaft. Right in each crotch formed by the arms is a little button that has a spring behind it that may be regulated in strength. The button projects a third of an inch into the crutch. The angle of the arms with the shaft is so small that a rock could not get down in it so far as to reach the button; but when the cable is caught by the hooks it presses down against the button, and thus closes an electrical circuit through a copper wire running through the grapnel's rope and the grapnel itself, and a bell is set ringing upon deck. But the experienced men in charge of the grappling are generally able to tell what the hook has hold of without the aid of the bell. They judge by the strain on the rope, which is indicated by a dynamometer on deck. The ordinary strain on the dynamometer is from 3 to 3¼ tons when the grapnel is dragging freely over a smooth bottom as the vessel forges slowly ahead. Sometimes a rock catches on the hooks. This frequently breaks off an arm, but sometimes it fetches clear, the strain indicated by the dynamometer informing the old sailor man in charge whether an accident has happened or not.

It took two hours and twenty minutes to get the grappling iron from the bow of the ship down to the bottom of the sea, 13,000 feet below. The cable used to drag it with is the patent wire and hemp invention of the Captain. The dragging began on July 25, the day of arrival, but they swept backward and forward over the territory for ten days without finding the broken telegraph cable. A good part of the time they were steaming back and forth day and night, and the only time when they were not doing so was when the weather was too bad. On such occasions they went to the buoy at the supposed end of the broken cable and hove to till the gale was ended.

Finally, on Aug. 5, the bell rang, indicating that the grapnel had caught the cable. The grapnel drag rope was thereupon fastened to a buoy and thrown overboard. Then the steamer went off two miles toward the end of the broken cable and got out a cutting grapnel. This is like the other one, except that there are knives in the crotches. When these crotches catch the cable and a strain comes on them they cut the cable off clean.

"Why did you cut off the cable there?" was asked.

"Because if we had tried to get up the

THE V. PRENTIS PUSH BUTTON.

bight of the cable where we first found it, the cable might have broken under the strain. That cable was laid in 1869, and is getting pretty well along in years. It would have been as apt to break on the shore side as the other, but when we had only an end of two miles to deal with we were sure of being able to get it up without damage. We grappled the European end first."

Having cut off the cable, the vessel returned to the buoy on the grappling rope, and getting the rope inboard again, led it to a drum six feet in diameter located on the upper deck and operated by a steam engine. Then they began to wind in the grapple rope and hoist the old cable to the bows. They started the drum at 1.20 in the afternoon of Aug. 5, and at 7.51 had the bight of it at the bow of the ship. Then the two miles and odd of end that was hanging down from the bow was fished up and stretched in lengths along the deck until the end was reached. This was connected with a very complete cable telegraph office located amidships, and a second later the operators who had been on watch for days in the British station awaiting this event saw the flashes on a mirror in their office that told them all about it.

Sometimes it happens that when an end of the cable is picked up in this way, and an attempt is made to communicate with the shore, it is found that there is another break, and that they have only the end of an odd section lying loose. Then they have to drop that over, after testing it to see how long it is, and go on toward the shore and begin over again. In this case, however, they found that they had hold of a sound wire to Great Britain. Without any delay, the end of a new cable was spliced to the old end brought from the bottom. Two experts, one who is trained in splicing cores, and one who is trained in splicing the outside or sheathing, are employed in this work.

When the splice was completed and tested and found perfect, the cable was started, running out around drums and grooved wheels controlled by brakes and over the stern, the old end having been led fair through these sheives before the splicing was done. Then the ship headed for shoal water and ran away at from three to four knots an hour until over a part of the banks where work could be done more easily than where the water was more than two miles deep. Of course this involved the abandonment of a good many miles of old cable. but the old cable wasn't of very much importance anyhow.

Arriving in shoal water the end of the new piece was attached to a buoy and put over board. Then the old cable was grappled and cut as before and a new piece spliced to it. Then the ends of the two new pieces were spliced together and the job was complete. It had taken nearly two months to do it, although in the meantime two easier jobs were attended to and a trip to Halifax for provisions was made, not to mention the encountering of the storm that damaged the rudder.

The Minia has a crew of 90, all told, including the Captain, three deck officers, a navigator. three expert electricians, four engineers, a purser, and a surgeon. A blacksmith and a boiler maker with their tools, are carried. There are three big, round tanks to hold the 600 miles of cable carried, which includes sizes to fit all the old cables under the charge of this ship. There is a cell room where the electricity for telegraphing is generated, and two dynamos with their engines, one to furnish electricity for a system of arc lights used when at work at night, and the other for the incandescent system that lights the ship below decks. The main saloon is large, and is comfortably and handsomely fitted. The Captain has a cabin under the turtle back aft, as fine as any Captain could wish for, and the other officers have rooms below that are as well fitted as those usually occupied by naval officers. The crew are all expert men, and get pay that averages a good deal better than the pay in the packet service between New York and Liverpool. The entire crew is kept under pay the year round, the ship making her headquarters at Halifax when not engaged in repairing cables. They are as comfortable a lot of sailor men as one could find anywhere.

A curious fact in connection with the immense amount of grappling done by this ship and the great number of samples of the bottom brought up by the sounding apparatus, the only products of human ingenuity ever raised by either grappling iron or sounding apparatus were two anchors of modern construction and one sample of ashes, evidently from some steamship. It is said that enough sailors have been drowned between New York and Liverpool to pave the bottom of the sea from port to port, and that enough fishermen have gone down on the banks to cover them three deep; but no human remains have ever been brought up, either by this ship or by any other dredger. Neither have any remains of the thousands of ships that have been wrecked in that region been encountered. What becomes of these wrecks and the bodies of the lost sailors is a mystery which the officers of the Minia have not been able to solve. Certainly, they say, if either remained intact on the surface of the sand at the bottom of the sea, either the grappling iron or the sounding apparatus, in passing and repassing thousands of times over a part of the ocean where the wrecks are most numerous, must bring up proof of their presence there.

A Neat Design in Push Buttons.

The attractive work in all branches of the electrical business is a matter in which every electrical man can take pride. In their detail work of house furnishing the V. Prentis Electrical Manufacturing Company, New York, deserves much credit in this line. A new and tasty design in push buttons, just brought out by this company, is meeting with much popularity. The button is illustrated herewith.

* * At Mancelona, Mich., electric light is to be put in shortly.

* * The V. Prentis Electrical Manufacturing Company has opened an office down town at 45 Dey street. Mr. John Day, of the company, will remain at the down-town office.

OUR LONDON LETTER.

To the Editor of Electrical Review:

I have just returned from a meeting of the Society of Telegraph Engineers and Electricians, held at the Institution of Civil Engineers, where two papers were read. The first was "On some Instruments for the Measurement of Electromotive Force and Electrical Power," by Dr. J. A. Fleming and C. H Gimingham, Esq.

Dr. Fleming read the paper which described a new and compact form of electrodynamometer, modifications of which served to measure both potential differences as a voltmeter, and current strengths combined with potential differences as a wattmeter. The apparatus is composed of two fixed parallel and horizontal double solenoids of wire, each double solenoid having a pole at its center. Two coils of wire attached to the ends of a pivoted beam encircle the solenoids with their axes normally concentric with those of the solenoids, each with each. The rings are thus capable of motion in a horizontal plane for a small angle each side of the normal position, as the beam may be deflected. A current traversing the rings and solenoids tends to deflect the beam, which is kept in position by torsion of a spring attached to its center, and from the amount of torsion necessary to keep the beam at its normal position, the strength of current is read from the torsion dial.

The second paper was on "Portable Voltmeters for Measuring Alternating Potential Differences," by Professors W. E. Ayrton, F. R. S., and John Perry, F. R. S.

The paper described in a very interesting manner, different practical modifications of a voltmeter, based like that of Captain Cardew, on the extension of a wire by the heat generated by a traversing current. The instrument in its simplest form consists of a very fine wire, 0.0014 inch in diameter stretched horizontally between two metal blocks. The potential difference to be measured is connected to these blocks, which are firmly fixed upon a suitable base. Above the center of the fine horizontal wire rises a support, from which a short piece of fine wire hangs vertically. The lower end of this vertical wire is connected to the center of the fine horizontal wire by a delicate ribbon spring of phosphor-bronze, very light, and so fine as to look almost like a wire itself. This spiral ribbon spring carries at its upper end, that is to say, at its attachment to the vertical wire, a light horizontal pointer over a horizontal scale.

The effect of the spiral spring is to draw the center of the fine horizontal wire upwards and sag it in the center, the amount of sag depending upon the elasticity of the fine wire, and of the vertical ribbon spring. When a current traverses the fine horizontal wire, the heat developed lengthens it and allows the sag to increase. The ribbon spring diminishing in length, its motion of contraction is much magnified in rotation by the pointer over the scale above. Professor Ayrton exhibited one instrument which gave 300° of pointer rotation for 14.22 volts, and he pointed out that this motion was swift, decided and almost deadbeat. By summing up the mathematical considerations of the apparatus, he gave the following general equation.

$$\phi^2 + 2\,y\frac{s}{r}\phi = \frac{A\,V^2}{1 + B\,V^2}$$

where ϕ is the extent of the pointer's angular displacement produced by a difference of potential V, y the vertical sag or upward displacement of the fine wires center, r the radius of the ribbon cylinder spring, s a constant for the metal of the spring usually about 3, A and B electrical constants depending on the construction of the instrument, B being usually small As a consequence he pointed out that when in the above equation y was very small, that is to say the sag was very small, the second term on the left hand became very small, and with B small the equation took the form $\phi^2 = C\,V^2$ where C is a constant, and hence that the angles of displacement were proportional to the difference of potential measured, whether that potential were direct or alternating.

Professor Ayrton went on to show that the instrument was portable, and not easily damaged by rough usage.

The discussion on these two papers was opened by Mr. Gordon, who, while doing justice to the ingenuity of the apparatus exhibited, observed that for practical engine-room use, they might have to undergo some little modification, as the requirements of an engine room voltmeter were chiefly dependence and clear indication, so that vertical dials were always the best.

Captain Cardew then spoke and did full justice to the principles of the instruments shown, particularly to the Ayrton & Perry voltmeter, which was constructed on a principle something similar to that of his own.

The further discussion of the subject was then adjourned to the following week.

A. E. KENNELLY.

London, England, Nov. 24, 1887.

Our Harbor Lights.

TO USE ELECTRICITY INSTEAD OF OIL IN LIGHTING THE BUOYS IN THE BAY.

There are some electric lights in New York bay, as anybody knows who has ever been to Staten Island after dark. Miss Liberty has one, and there is one in the lighthouse on Robbin's Reef. Heretofore, however, none of the buoys have been lighted by electricity, but with kerosene. There is soon, however, to be a change. Electricity is furnishing the light of the age, and there appears no good reason why it should not light the buoys in the harbor as well as the lighthouses.

A contract has just been made for 2,000 feet of submarine cable, to run from a shore station near Tompkinsville, Staten Island, to one of the buoys—probably No. 18, a spar

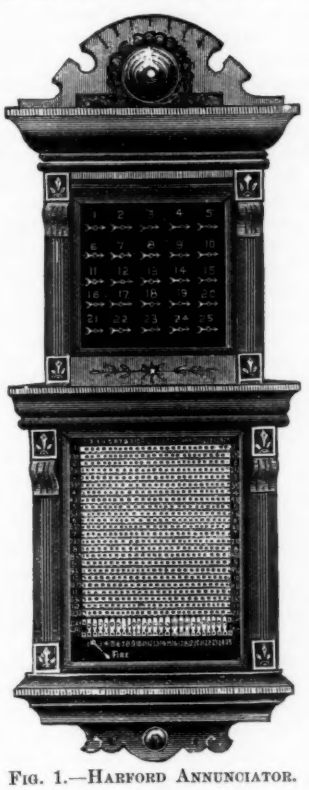


FIG. 1.—HARFORD ANNUNCIATOR.

buoy. There is a small dynamo in the lighthouse tower, and it is intended to use that as a generator. The cable will contain only the wire for the one light. On the buoy will be placed a thirty candle-power incandescent lamp, which will be supplied by the current coming through the cable. The light will, of course, be very much brighter than that used at present. It will also be easily distinguishable from other lights, such as those on vessels, and will no doubt be in every way satisfactory, provided the cost does not exceed that of the lamps. If this light works satisfactorily, it is expected that all the lighted buoys in the harbor will be supplied in the same way. If they were, the services of the oil supply boat and the men employed upon it, could, to that extent at least, be entirely dispensed with. It is not thought that the cables will be interfered with by anchors, as they can be laid over portions of the bottom where anchors are seldom cast, and as they will, of course, unlike the cables laid across the Narrows, be entirely out of the track of incoming and outgoing steamers. The present work is in charge of Lieut Millis, stationed at the government yard at Tompkinsville.

The Siemens & Halske Motor.

The development of central-station lighting in Berlin has caused the well-known house of Siemens & Halske to bring out a line of small motors, adapted to be used in the arc or incandescent circuits of the city.

The accompanying cut shows the style of the motors, which are made in four sizes,

SIEMENS & HALSKE MOTOR.

from one-tenth to one horse power. A single coil excites the field, and the armature is of the Gramme type. The *tout ensemble* is strikingly like the Van Der Poele motor. The winding, of course, varies according to circumstances.

The following are the data of the different sizes:

No.	H. P.	Speed.	Watts per sec.	Potential.
K 1	0.1	2,500	150	10 to 120 v.
K 2	0.2	2,200	300	20 to 120 v.
K 3	0 5	1,800	700	30 to 250 v.
K 4	1.	1,500	1,200	48 to 500 v.

Harford's Clock and Guest Call.

The protection against danger by fire at hotels is a feature that always appeals to popular favor, and every advance made in this direction deserves prompt recognition. In view of the increasing demand for electrical appliances, and the large number of deaths and accidents occurring by fire in hotels, etc , the Harford Electrical Company, of East Saginaw, Mich., have invented and are manufacturing a simple, sure and durable

FIG. 2.—CLOCK AND GUEST CALL.

automatic guest call and instantaneous fire alarm. It consists of the usual office clock, an electrical annunciator, and a switchboard, showing room numbers, which are placed in the office of the hotel. The switchboard it mounted in cabinet work of modern design, and makes a rich addition to the furnishings of any hotel office. It is compact, and any available wall space can be utilized. In each room of the hotel are placed the common push button and electric bell; the batteries are located in the cellar or otherwise, as desired, and the whole is operated as follows:

Should one or more guests desire to be called at, say, 5 o'clock, the clerk simply inserts a common switchboard pin in the room numbers on the switchboard of the rooms occupied by the guests desiring to be called. Should other guests wish to be called at 5.30 o'clock, insert pins in their respective room numbers, and so on, for all the whole and half hours of the day and night. Any number of guests can be called at any or all the whole or half hours. No further attention need be given to the matter, as, when the hour hand of the clock reaches 5 o'clock, all the rooms switched on to that hour have the electric bells in their respective rooms rung automatically until the guest arises and pushes his push button, when the annunciator drops, thus indicating that he has arisen. The clerk can then remove the pin from the room number of the switchboard indicated by the annunciator, or he can leave it there, as the bell in the room will cease ringing in from one to four minutes. The same follows with guests desiring to be called at 5.30, 6, 6.30, etc.

If it is desired at any time to immediately ring the bell in any room, the clerk simply presses on one of a number of springs, numbered to correspond with the numbers of the rooms, and immediately the bell in the room of like number rings. One can ring it as often as he cares to, by easing up on the spring and again putting on the pressure.

In the event of a fire, or when a general alarm is necessary, simply push over a lever, which is immediately caught and held fast, thus instantaneously and simultaneously ringing all the bells, which continue ringing until the lever is released. Two views of the system are shown, one presenting a view of the clock and call combined, the other the office annunciator.

Electric Tram Cars.

In a recent issue, our Berlin correspondent gave a description of the new electric tram car tried on the Cologne railways by Messrs. Herbrand & Co., of Ehrenfeld. The whole electrical installation on this car has been designed by Mr. Huber, of Hamburg, who had two cars on the same system running in that town from the 1st of May to the 25th of December, 1886, but which were withdrawn at that date, as it was found that they were not sufficiently powerful to overcome the resistance of the track when the groove in the rails was filled with snow or ice. We have received a letter from Mr. Huber, referring to the question as to what power should be provided for electrically propelled cars, and as he has had a large experience in this subject, his figures will probably be of interest to our readers. Mr. Huber estimates that on an average road, with gradients not exceeding 25 per 1,000, the energy which must be stored in the cells is 7.6 watt hours for every 100 kilo. of rolling load moved a distance of one kilometer. Reduced to English measure, this works out to 125 watt hours per ton-mile. Allowing an efficiency of 80 per cent. from the indicated power of the engine to the electric output of the dynamo, we require .21 I. H. P. hours for every ton-mile. Thus, in a tram service employing 15 cars, each weighing 8 tons when full, and where every car runs 70 miles, the daily charging power required would be 1,760 I. H. P. hours. If the time of charging is 15 hours daily, steam power to the amount of 117 I. H. P. would have to be provided. The power naturally varies with the condition of the road. In warm, rainy weather, less than the amount here given will be required; but when the road is clogged with dirt, ice or snow, something more should be allowed.—*Industries.*

Photographing Bullets in Motion by the Electric Light.

An Austrian physicist, Herr H. Mach, of Prague, has made some interesting experiments on photographing rifle bullets in motion by means of the electric light. In doing this he illumines the bullet by letting it break an electric current formed, but the velocity of the bullet must exceed that of sound, in order that the conditions of the air before and behind the projectile can be shown. After many experiments, Herr Mach succeeded in photographing projectiles fired by Mr. Wernal and Mr. Jurde's guns, having respectively an initial velocity of 438 and 530 meters per second. The photographs thus obtained showed an air formation in front of the bullet having the form of an hyperbole, whilst behind it almost a vacuum was formed, in which, when the initial velocity was very great, there were some curious spiral motions. On the whole, there appeared from these photographs to be a great similarity between the motion of a body through the water, and that of a projectile through the air.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. BOX 3329.

GEO. WORTHINGTON, - - - Editor.
CHARLES W. PRICE, Associate "
T. J. MCTIGHE, Electrician and Manager Patent Bureau.
LOREN N. DOWNS, President.
ANDREW J. DAM, - Vice-Pres't and Treas.
C. C. HASKINS, GEO. A. HAMILTON, } Consulting Electricians.

REGISTERED CABLE ADDRESS:
"Electview," New York.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries, $4.00, in advance. Postage paid by publisher.

ADVERTISING.

Transient, 25 cents per line, nonpareil.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all Express Money orders, P. O. orders and checks, payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill., will represent the REVIEW in the West
Messrs. Wm. Dawson & Sons, 121 Cannon Street, London, England, are our representatives for Great Britain.

NEW YORK, DECEMBER 17, 1887.

CONTENTS.

	PAGE
Bernardo's Method of Electric Welding. By Dr. R. Ruhlmann	1
Electricity for Lighted Buoys	1
Electricity as a Source of Heat	1
He Hoped His Telephone Would be Out of Order	1
Two Miles Under the Sea	2
A Neat Design in Push Buttons	2
Our London Letter	3
Our Harbor Lights	3
The Siemens & Halske Motor	3
Harford's Clock and Guest Call	3
Electric Tram Cars	3
Photographing Bullets in Motion by the Electric Light	3
The Brush Company Wins in England	4
The Very Latest Electrical Discovery	4
The Bernardo Electric Welding System	4
Cats as Counterbalances	4
Our Chicago Letter	4
Our Boston Letter	5
Our St. Louis Letter	5
Electric Club Notes	5
The Telephone Inquiry	5
Telephonic News	6
The Biggest Telephone Company and Its Management	6
The Telephone in Canada	6
The Telephone and the Stammerer	6
Western Telephone News	6
Government Telegraphy	7
Possible Uses for the Phonograph	7
New Work for Messenger Boys	7
Testing the Lad's Honesty	7
Disaster to a Great Copper Mine	7
Telegraphic	7
Electrical and Scientific	8
The Requirements of a Course of Electrical Engineering	8
The Burton Electric Heater in Railway Cars	8
Starting Mitchell, Vance & Co. Again	8
Friction Driving Gear for Dynamos	9
Electric Light at Pullman, Ill.	9
Electric Light News	9
Electrical Patents	10

Telephone men may now prick up their ears. The Legislatures will soon be in session.

The destructive fire in the Calumet and Hecla copper mine and the late report of its caving in, is the main cause of the recent advance in the price of copper. The electrical business will undoubtedly feel the effects of this advance. A number of the leading manufacturers of copper wire have withdrawn all quotations, or give them subject to change without notice.

The meeting of the National Electric Light Association in Pittsburgh next February will be the occasion not only of the usual discussion of electrical progress, but of a spirited election of officers. There are a number of aspirants for office and a number of good men from whose ranks to select. The question of location of the next place of meeting will probably enter into the contest.

An interesting item appears in the testimony before the legislative committee on telephone rates. It appears that in one day in New York 51,000 telephone calls were handled—an almost incomprehensible number when you consider that this means 102,000 persons conversing over the telephones in New York city in one day. To handle these calls successfully was a triumph of telephone skill and management indeed.

THE BRUSH COMPANY WINS IN ENGLAND.

In the suit in England by the Anglo-American Brush Electric Light Co., against Crompton & Co., for infringement of the former's patent on compound wound dynamos, a settlement has been reached, by the defendants acknowledging the validity of the patent in question, and taking a license under it. This gives the Brush corporation a strong position in England, unless other manufacturers take up the gauntlet and assail the patent. Messrs. Crompton & Co. seem to have given up the contest on the submission of proofs that a Brush plating dynamo built ten years ago, and provided with his "teaser coil" in addition to the shunt field, actually maintained a substantially constant potential under great variations of resistance in the plating circuit, and acted generally in accordance with the somewhat obscure terms of the English specification of the Brush patent of 1878.

THE VERY LATEST ELECTRICAL DISCOVERY.

A Washington correspondent of the New York *Sun* thus amuses himself about the installation of the Westinghouse system for lighting the Capitol:

Workmen are very busy tunneling the walls immediately under the Senate Chamber for the purpose of placing electric light wires. Electricity was used to light the chamber last year, but a different plant is now being put in. Several Senators and other persons are somewhat averse to putting these wires under the chamber. They are apprehensive of an explosion or other accident. The tunnel is being made directly underneath the floor of the cloak rooms, the places to which the Senators retire to smoke and chat. The sofas and chairs will be placed over the holes through which the wires run. Some of the older Senators remember with anything but pleasure two gas explosions which occurred in the Senate, and they don't want them repeated One happened in the corridor just in front of the passenger elevator. The pipes beneath the flooring burst, and had it been during the busy part of the day some one would undoubtedly have been killed. In 1876 a gas explosion occurred in a room near the restaurant beneath the Senate Chamber. The room had not been used for a long time, and when an employe struck a match in it he was blown through the doorway out into the corridor, and burned nearly to death. An other man who had gone into the room was blown against the wall ten feet away and killed. Senator Burnside was speaking at the time, and with other Senators was badly frightened. This is why some of the Senators look askance at the work of placing electric light wires under their very chairs in the cloak room.

This is refreshing. We were not aware that the Westinghouse Co. had brought ou an explosive electricity which only needs at hole in the floor and a sofa above it, occupied by a millionaire Senator, to swell with indignation, and, like the fabled dragon, come out of its hole and proceed to demolish the aforesaid Senator. But let the apprehensive Senators take comfort. Rat traps are cheap. Move the sofas, bait the traps with condensers, and set them near the holes, and as fast as the new electric monster appears the superior microfaradic proclivities of the condenser will fasten to the aforesaid monster, and the Senators can have all the fun they want. They must not be frightened by this threatened invasion of their inalienable rights to lounge on the sacred sofas of the Capitol, no matter how vivid may be their individual recollections of the ravages of "Kentucky lightning."

THE BERNARDO ELECTRIC WELDING SYSTEM.

Our foreign contemporaries announce the advent of this new system of electric welding. The novelty lies in the application of an arc produced between a carbon positive and the metals to be welded acting as negative. This arrangement is ingenious, since it prevents oxidation and volatilization of the metals. We fear its application cannot be carried to the welding of structures in which the preservation of the precise character and tensile strength is important. Analysis of steel plates welded by the Bernardo process show a marked difference in the constituent parts. The carbon was reduced almost 50 per cent., as also the manganese. From our point of view this would prove a very material and undesirable change in the character of the metal. But for very many and varied uses, the arc-welding process would seem to be a very convenient method of accomplishing the junction of metals. The portability of the apparatus for local application—merely a pair of conductors, a negative clamp, and a carbon rod with insulated handle—lends itself to uses where the Thomson process could not be adopted. In effecting union by this process, Dr. Bernardo causes the surface metal to be actually melted, and the intense heat obtained is strictly localized to the point where the arc strikes. This adds another uncertainty, because of the liability to produce internal strains in the metal. On the whole, the Bernardo process is handicapped by many difficulties of a nature entirely practical and not to be avoided by electric action *per se*. Still, it is interesting, and may have a wide application in the minor industries.

It is less of a welding process than a process of joining metals by locally melting them into union. As to the relative efficiency of the two processes, we incline to the belief that the Thomson process is the cheaper. As constituted, the Bernardo plant requires a dynamo suitable for charging an accumulator, constantly running and doing work, while Thomson's plant is running idle except when actually welding.

At a test of the Bernardo process reported by our contemporary, the *London Electrician*, it is said that apparently "the weld is perfect, but the iron is rendered porous, so that a tank electrically welded is not water-tight." It is not unlikely that this defect is due to the burning out of some of the carbon, manganese or other constituents, or to cracks determined by the vagaries of contraction and expansion above noted. There is much to do yet to make the Bernardo process practicable.

CATS AS COUNTERBALANCES.

From time to time one hears of various mishaps by which cats fall into the path of fly-wheels of engines, and are carried round and round for hours on the inside rim of the wheel, and generally the information concludes with some observation upon the wondrous muscular power of cats, enabling them to hold their position for such a time.

A dog in the engine room of a public station of the water-works while looking through a slit in the floor provided for the wheel, saw a cat in the basement below. He attempted to spring upon her between the spokes of the wheel, but was caught and carried around on the inside rim for a number of revolutions. On his release he would not ever enter or approach the building again.

The engine tender of one of the large armories in Connecticut perceived what he supposed to be a piece of newspaper on the inside of the fly-wheel of the engine, and was somewhat provoked that anyone should be so disorderly as to throw a paper in that way. But when the mill was stopped at noon, a cat jumped out, and instead of being affronted or permanently terrified by the involuntary ride of several hours, did not abandon the engine room.

The engineer in a printing office of one of the newspapers in Montreal discovered as he thought a large piece of paper on the inner rim of the fly-wheel, and at the expiration of five hours, when the engine was stopped, a cat jumped out, somewhat demoralized but not permanently injured.

Instead of wondering how a cat could hold on under such circumstances, an examination of the facts will lead one to question why the beast was not squeezed to death by centrifugal force. Applying the formula, and assuming what appears to be a proper limit for the radius of gyration of a cat, shows that the centrifugal force in this instance on the inside rim of the fly-wheel of the engine, which was ten feet in diameter, revolving fifty times per minute, was 5.76 times gravity; so that the cat was really pushed at all times against the rim, with a pressure at least 4¾ times its own weight.

The physical results of such an enormous pressure can best be conceived by considering its effect upon a man weighing 175 lbs., where this excess of external pressure would amount to 731 lbs., a weight which few would care to sustain for a short time, and certainly none for hours.

OUR CHICAGO LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

Chief among the "boomering" towns of the West stands Kansas City, Mo., and it is, moreover, one of those towns where there is no possibility of the adjective being converted into the name of the Australian's Club, which, as the Englishman said, kicks backward.

The Electrical Supply Company, F. S. Terry, manager, has established an agency at K. C., at 125 West Sixth street, and placed Mr. Chas. H. Cone, selling agent, in charge. Mr. Cone is well known throughout the South and West, and will, without doubt, make a glad success of the new venture.

At New Orleans, on the night of the 4th instant, a rain commenced falling, which continued by fits and starts for about eight or ten hours. It was the first that had fallen, to amount to anything, in two months, and thoroughly drenched and covered everything. Saturday morning Mr. Wm. Hartman, who sells creamless milk, was the possessor of a horse and milk cart, but Sunday morning the horse's legs had a misunderstanding with some wires which deprived the dairyman of his noble Selim. Mr. Hartman undertook to interfere in the scrimmage, and came quite near abandoning the milk business with the horse. The tale, as told by an evening paper, incongruities and all, is as follows:

"There were two wires lying across the street, the ends of each resting on the sidewalk, while the continuation of the wires were at the top of an adjacent pole. The wires had been cut or burned apart near the top of a house near by, and had fallen down into the street, and the ends being in water, kept up the current, which must have been very strong to have killed the horse so suddenly. The hair of the horse was burned along his right foreleg, and immediately under his stomach the flesh was burned to a crisp. There was much indignation expressed by some of the neighbors concerning the carelessness of the company owning the wires, for it was clearly seen that in all probability the death of the horse saved human life. The horse was a fine one, and his owner is much grieved on account of his death.

"The wires were those of the Brush Electric Light Company, and a reporter called this morning at their office, No. 38 Union street, and was informed that the accident had been caused by the fire alarm telegraph wires coming in contact with the Brush wires, whilst the former were charged, sounding a fire alarm. The latter were burnt in two by the connection and fell into the street; and

it was surmised that the horse must have stepped on both wires at once, or he would not have been killed."

It is hard for the electric light man to leave and not return to the business. There seems to be a fascination in it—a sort of magnetic attraction, which sooner or later reclaims and restores the wanderers. Mr. Wm. Brennan, formerly of telegraph, telephone, and finally of electric light prominence here, has returned to his former love, and has been put in charge of the outside electrical and mechanical work of the Chicago Arc Light and Power Company. One of his first improvements was recently put into service with excellent results. It is an ordinary glass insulator, with a "bucket hitch" of wire upon it, while the top end of a screw pin with a hook attachment is firmly fixed inside. The insulator acts as a break from which to hang lamps, and is a most excellent, cheap and readily handled arrangement.

The different summits from which the field is viewed by the inspector and the electrical merchant are far, far asunder. Neither can see with the eyes of the other; and until that time when the entire population shall see everything alike—but there will be no dynamos, storage batteries or motors then, to shock us, no current to scorch our feathers. Everybody will be running round with a piece of a star or a chunk of a moon for a hand lamp. But it is hard, sometimes, to have to refuse a good-natured agent, or inventor, or owner, a privilege which he cannot see the least possible harm or danger in. Somebody said once that "different people have such different thinks."

At the last meeting of the Electric Club the attending members were well entertained by a paper on "Magnetism in Watches, and its Control," by C. K. Giles, of magnetic shield fame. The paper was illustrated by both diagrams and experiment, and elicited a very general discussion, and an unanimous vote of thanks was tendered Mr. G.

The roll of membership now counts 187 names, and the daily gathering at lunch hour has increased to an unexpected extent, because of its social features; and this roll also is growing.

The entertainment committee are quietly arranging for a grand banquet during the first days of January. You learned electrical pundits resident in Eastern valleys are repectfully counseled to "take due notice thereof (as President Morrison once said to the convention) and govern yourselves accordingly!" We shall want you here on that sad and solemn occasion.

Callers at the club during the week have been Griscom, of the New York Accumulator Company; Boulton, of the Standard Carbon Company; Stanley, of the Westinghouse Company; Little Mack, of the Baxter Motor Company; Cutter, of the T.-H. Co., and others.

Mr. J. H. Reid, western agent of the Mather Co., has had his territory increased, and it now includes Ohio and Missouri.

Billy Buckley, of the Fort Wayne Jenney, one of the busiest bees in the hive, has contracts for 1,000 glow lamps at Salina, Kas., and 600 of the same at the Armour packing house, Kansas City.

The Fort Wayne Jenney people at New Orleans, which, in general terms, means M. J. Hart, manager, will soon be in the field with incandescent lights, in competition with the Edison and Westinghouse-Brush companies.

Leonard & Izard have recently completed the installation for the N. W. Railway shops. The plant embraces 1,100 lamps, four dynamos, two of 225 lights each, and two of 300 each. The lights are distributed through thirteen buildings, on the Edison three-wire system. With every lamp burning, the variation of pressure between any two lamps is only 1½ volts, while with an average load it is only 1 volt. The lamps are the new Edison, which shows first class results.

Rumor has it that Mr. C. N. Fay, general manager of the Chicago Telephone Company and president of the Chicago Arc Light and Power Company, is about to resign these two positions, and accept the presidency of the Gas Trust. C. C. H.

Chicago, Dec. 12, 1887.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

A meeting of the Electric Club was held at the club rooms on Boylston street on Thursday evening last, at which the officers and executive committee for the ensuing year were elected. P. H. Alexander was elected president; William J. Denver, 1st vice-president; Suel Smith, 2nd vice-president; E. Wilbur Rice, jr., 3d vice-president; Frank Fuller, 4th vice-president; F. J. Boynton, treasurer; Robert F. Ross, secretary; Allan V. Garratt, historian; and Messrs. Frank Ridlon, A. H. Chapman, C. M. Ransom, H. B. Cram, H. J. Pettengill, Edward Blake, Leopold Schlegelmilch, William Brophy, A. L. Rohrer, Geo. W. Adams, Henry B. Lytle, J. T. Moriarty, S. E. Barton, W. I. Barker, George W. Davenport, H. H. Eustis, H. N. Sweet, E. L. Caldwell, F. C. Clark and J. R. Lovejoy, executive committee. The election was held under the new constitution of the club. Under the old constitution the annual meeting will be held on Thursday, the 15th inst., at which the committees of the present year will make their reports.

On the following Saturday the annual club dinner will be served at the rooms, and, altogether, the Electric Club is booming and its friends are happy. Prof. E. A. Dolbear will lecture on some department of electric lighting, on Monday, Dec. 19. His exact subject is not yet announced.

The Riley Elevated Railroad Company have petitioned the Legislature of Massachusetts for a charter to operate an elevated road in Boston on their system, using the Thomson-Houston electric motors for propulsion.

The Sprague Electric Railway and Motor Company is installing a large number of motors in the New England States. Among the recent places to undertake the supply of power by electricity are Middletown, Conn., and Northampton, Mass. Brockton, Mass., Woonsocket, R. I., and Milford, Mass., have lately increased their facilities for motor work.

During the past week an electric street car has, for the first time, invaded the crowded streets down town. On Tuesday a car of the Cambridge railroad, fitted up with a Weston electric motor, passed through Washington street just at the noon hour. It was under the immediate supervision of Col. C. H. Hewins, the general superintendent of the company, and naturally attracted a great deal of attention. The car derives its power from Julien storage batteries, the 120 cells used being placed under the seats. The motor is placed beneath the center of the car and the power transferred to the wheels by means of ten wire belts running from the motor to a pulley on the axle. Col. Hewins states that the car has always returned to the stable without the assistance of horses, although it has made a large number of trips and has climbed the worst grades of the Cambridge road. It will probably soon be placed in the regular traffic between Cambridge and Boston, to give it opportunities to practically demonstrate its ability and reliability.

Mr. Garfield, of the Thomson-Houston Co., is making a flying trip through the South this week. Mr. Mansfield, at the head of the motor department of the same company, has been confined to his house for some time by illness.

The Boston *Record* asserts the following in regard to telephoning to New York:

"It costs $2 to converse with New York for five minutes by telephone. This admits of twenty-five 'hullos,' an equal number of 'is-this-New-York?' fifteen 'step-a-little-away-from-the-transmitters,' same number 'can't-hear-a-word-you-says,' unlimited expletives. And your message? Well, it will cost $2 more to send that."

But the *Record* is usually truthful.

Some recent tests by the Institute of Technology on the efficiency of the Sprague motors have shown very satisfactory results.

The old house of Thomas Hall, on Bromfield street, is doing a large business in their medicinal batteries.

Frank W. Harrington, of the Western Electric Co., has been in town several days this week. T. W. S.

Boston, December 12, 1887.

OUR ST. LOUIS LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

I have an idea that your opinion of St. Louis is that it has been absorbed in a fog, not having heard from it for so long a time. But being out of the city must be my excuse. Matters electrical are looking up to some extent, as the gas companies are giving very poor service indeed. There is a company of St. Louis gentlemen endeavoring to secure orders for an improved luminous burner. The method of operation is to let the customer have the use of the burners at the rate of $1.50 each monthly rental, telling the parties that the cost of operation will not exceed 3 cents per hour. They look well enough from a standpoint of polished brass and ornamentation for the first week, but after becoming begrimed with soot and spoiling the customer's ceiling with the usual amount of coal smoke and other gaseous products, a thought creeps into the mind of the party that must pay the piper as the work of disfiguration goes on, that he will examine the prospectus of the philanthropic souls that are doing so much to create comfort for gas consumers and their families in this troubled world. He then find out that the parties concerned are all more or less interested in the different gas companies. He gets mad, looks over his contract, and finds out that "they have by a skillful wording of the contract scooped him." The result is the gas is shut off, ceilings cleaned from the products of imperfect combustion, and an incandescent plant contracted for or rented from the central station.

The United States Company have just started a 100-light plant in the Stiful furniture factory that is giving excellent satisfaction.

The Edison agency reports sales as follows in this city:

Post Dispatch Printing Company, 400 lights; Pauley Rail Manufacturing Company, 150 lights; J. H. Conades Chair Company, 200 lights; St. Charles Can Company, 50 lights; Independence, Mo., 500 lights; Ringan Packing Company, Kansas City, 400 lights. The Jenny Company, of Fort Wayne, closed with the Armour Packing Company, of Kansas City, for 200 lights of their new incandescent system. The sudden advance in copper may interfere with anticipated profits, but it is to be hoped that the top has been reached.

Col. Beetle, of the Western Electric Company, was in town a few days ago, and elicited from a young lady type-writer the remark that she wished she was an electric light agent, as they never grew old and cross, like other people. After such a pretty remark from so pretty a young lady, the best the gallant Colonel could do was to say, as he looked at his shadow on the floor: "Never mind the change, young lady. I will have some more manuscript down tomorrow."

Mr. J. M. Bates, of this city, packs his valise for a trip through "Dixie" in the interests of the Edison Company.

The Western Electric Construction Company, of Kansas City, report business good.

—— The Lebanon, Pa., Electric Railway has been incorporated. The capital stock is $50,000 and among the directors are C. H. Merley, T. C. Sperit, R. J. Merley and J. W. Grove. The councils have not yet granted a franchise.

—— The newly elected president and secretary of the Boston Electric Club, Messrs. P. H. Alexander and R. F. Ross, were New York visitors this week. Col. Ransom, proprietor of *Modern Light and Heat*, accompanied the visitors, and met several New York friends.

—— The Callender Company has recently contracted with the Thomson-Houston Electric Light Company, of Buffalo, whereby all the overhead circuits of that company are constructed with Trinidad line wire, the new insulated wire manufactured by the Callender company. The Columbus, Ohio, Electric Light and Power Company, we are informed, has also adopted this wire.

THE TELEPHONE INQUIRY.

The Committee of the Assembly charged with inquiring into the rates charged by the telephone companies in this State, their business methods, and their relations with other companies, has been in session in this city during the past week, and has examined a great number of witnesses connected with the New York and New Jersey and the Metropolitan companies, and also a number of subscribers, who, although coming as individuals, were prompted to do so by the Board of Trade and Transportation—an organization whose importance is by no means to be measured by the length and pomposity of its name. Vast accumulations of statistics have been presented, the preparation of which has engaged the services of a number of expert accountants for weeks, and if the committee can put them through the first stages of digestion in the limited time now at its disposal, it cannot hope to do anything else between now and the second Tuesday in January. The examination has been conducted chiefly by Mr. Ainsworth, chairman of the committee, the drift of whose questions it is not always easy to follow. He seems to be more fond of propounding conundrums of his own invention than of listening to straightforward statements of facts. The committee devoted the last part of the week to completing its inquiry at Rochester, where it had already held one session.

Electric Club Notes.

Three members of the club, Messrs. C. D. Haskins, H. B. Thayer and John A. Seely, are largely interested in a new and improved gas burner, which may bring them in great wealth.

The club management has given up the rooms at the hotel. All meetings are now held at the new club house, 17 East 22nd street, where a number of members are regular callers. As soon as the electric light fixtures are put up the opening will occur.

A very elegantly framed and excellent likeness in water color of Mr. Thomas A. Edison was presented to the club by Mr. Edison.

Should Captain W. E. Van Reed, 5th U. S. Artillery, be retired, under his recent examination by a retiring board, Lieut. E. L. Zalinski, of gun fame, will attain a captaincy. His fellow members of the club will congratulate.

Arrangements are to be completed this week so that members can dine at the new club house.

There are about thirty applicants for membership awaiting action by the membership committee.

With two dynamos, the street circuit and a storage battery plant, the electric light of the club will never fail to shine.

—— The Sawyer-Man lamp factory, Brooklyn, was burned down Tuesday last. The Pittsburgh and Lynn factories will be taxed to fill orders.

—— News of the recent Beach-Hanlan boat race at Sydney, New South Wales, reached this country by overland telegraph to North Australia, by cable to Java and Sumatra, and to Madras, India, thence to Aden, Africa, and up the Red Sea to Suez, across the Mediterranean to Trieste, across Europe to London, and thence by Atlantic cable.

—— *La Lumière Electrique* of November 12 states that photometric comparisons of incandescent lamps were recently made at Antwerp to establish the following four points: First, the mean horizontal intensity of the light; second, the relative intensity under different angles; third, the mean spherical intensity; fourth, the variations in the luminous intensity with varying electromotive force and strength of current. The means for determining these qualities necessitated elaborate apparatus. The experiments demonstrated the mean horizontal intensity to be .919 for a given lamp, while the mean intensity at 45° or transversely was .915. The relative intensities of angular rays were ascertained and graphically illustrated by curves. The mean spherical intensity was found to be .8 that of the horizontal intensity. The variations of luminosity due to varying electromotive force and current strength were different for each special kind of lamp, but a definite formula was deduced and confirmed the experimental results mathematically.

Telephonic News

*** The N. Y. and N. J. Telephone Company has 6,458 subscribers.

*** Telephone wires connecting Bridgeport with New Haven, Hartford, Springfield, Worcester, Providence and Boston, are being put up on the line of the Central Massachusetts Railroad.

*** Prof. A. K. Eaton, one of the early workers on the telephone, has removed to 191 Fulton street, Brooklyn, where he will continue the manufacture of instruments for electrical measurement.

*** January 1st the new telephone lines of the American Telephone Company extending from New York to Boston and Albany, will be ready for commercial use. The line from here to Boston has been tried and works perfectly, and no difficulty is experienced in talking from Philadelphia to Boston—nearly 400 miles.

*** Chief Walker, of the Electrical Bureau, Philadelphia, is well satisfied with his experience with conduit wires. "Underground telegraphy," he says, "is here and has come to stay. The city has set the example, and it having proved a success, it is now only a question of a few years when the poles must come down. Of course, the overhead system will not be abolished until time has effectually proved the efficiency of the underground plan. We are anxious to get every wire in the city underground just as quick as possible, and will cheerfully give the aid of the department to accomplish that end. It will lessen our labors in keeping the city's wires in prompt working order, and prevent the annoying accidents which necessarily occur from overhead wires. We also put down three miles of cable inside of the Girard College grounds for electric lighting purposes. The city now has ten and one-half miles of electric lighting cable. If the city should decide to do her own electric lighting altogether, we would first move to put them underground, as the heavy electric wires are the most dangerous of any. We have done a great deal of work in the way of laying telephone and telegraph wires."

*** Mr. Chas. Dutton, auditor of the Southern Bell Telephone Company, New York, delivered a lecture, entitled: "What is the Telephone?" before the Y. M. C. A., of Orange, N. J., Wednesday evening, Dec. 7. The lecture was illustrated in a graphic manner, showing the telephone circuit through the telephone, transmitter and battery, and was presented interestingly and clearly. Through the courtesy of the orator's telephone friends, a metallic circuit was run to the hall, and all were permitted to talk with Boston, New York, Philadelphia and intermediate points. The ease with which conversation was carried on between these distant points was a great surprise to the auditors, who were thus made to realize the great advance that had been made by the telephone.

A number of good points were made by the lecturer, whose well-known penchant for looking at the sad and sober side of things did not prevent his alluding to the several humorous incidents that go to make up the complete telephone history of the country, particularly in the line of its use by the inexperienced.

*** Gen. Martin Beemas, attorney for a Chicago firm, has completed a contract to apply a patent which possesses many elements of novelty to the barb wire fence of the X. I. T. cattle company, located in the pan handle of Texas. The patent is a process by which a constant current of electricity is passed either through barb wire or through a plain galvanized wire. The first contact is enough to prove to any animal that the fence is loaded. At present a barb wire fence surrounds the range in question, and the current will be passed through the top wire. Telephonic communication can also be made from any point to headquarters by attaching a ground wire and a small telephone, one of which will be carried by each cowboy. Any break in the fence will also be noted at headquarters by the constant ringing of a bell. The X. I. T. range is that received by United States Senator Farwell, his brother, J. V. Farwell, and Abner Taylor for building the Texas State house. The tract is larger than the State of Illinois, and immunity from the dangers of a barb wire fence is worth thousands of dollars yearly to the company which owns the 120,000 cattle inclosed in this vast area.

The Biggest Telephone Company and its Business Management.

The assembly committee having in charge the investigation of the telephone business on Saturday last interrogated Gen. Huidekooper, the Vice-President and General Manager of the Metropolitan Telephone Company, of New York city, as to the different kinds of service furnished to the patrons of the company, the charges for which varied from $60 to $180 a year, as testified to by him at the previous day's hearing. The General said that the company has now 6,929 subscribers, which includes 100 toll stations, classed as subscribers. He was asked to explain the service furnished to the $60 men, and said that this was the rate to residents of Harlem for local service. If they desired to talk to any one outside of Harlem they paid other rates. The company has only thirty-one subscribers who use it locally, and the witness further explained that at present there were only four rates—$180 for the Law Service, $150 for the Metropolitan $100 for resident rates and a separate $5 rate for residents who have a business telephone down town. The company has seven or eight men at the court house to run over the court records and notify the subscriber in regard to his cases for the next day, and also during each day to notify him when his case was called, so that the lawyer might wait in his office until the last moment before going to court. This also applies to the Brooklyn court.

Of this class the company had 429 customers on Oct. 5 last, and probably 500 at the present time. The company pays its operators in the court house $40 a month. The company pays a rental to the city of $600 a year for the privilege of placing its instruments in the court houses. The Brooklyn service is attended with considerable more expense than the service here. It pays $30 a wire for every wire across the Brooklyn bridge as rental.

The $150 rate applies to business men in this city, and includes a number of stations in Jersey City and Brooklyn, as well as the privileges of the Stock Produce and other exchanges. The company pays $4,000 to the Stock Exchange for its privileges on the floor, and also pays the other exchanges. It has operators in those marts, whose duty it is to find the man called for. On Oct. 5 last the company had 4,825 subscribers at $150 each. When a man uses four telephones a discount of 10 per cent. is made, and there were fifty of those on the date mentioned, or 200 telephones in all. In some instances there are customers who use more than four; the Public Works, for instance, has fifteen or twenty telephones, and for these there are fixed special rates. There is no extra rate for extra distance. There are two men at Fort Washington, fifteen miles away, who have telephones in their houses for $75. With the Pennsylvania Railroad there is a special arrangement, the company furnishing privileges in the offices which offset the charge for telephone service. There is a $100 rate for citizens of New York who want telephones in their houses for domestic or social purposes. Where, however, they had a sign out and made an office of their houses, they were charged business rates.

In 1884 the number of subscribers was 4,717; in 1885, 5,138; in 1886, 5,844; in 1887, 6,817. The company has 690 private lines, the rate for which was fixed by special arrangement, ranging from $150 to $800.

The highest rate is to Newark. Most of these private wires run into the Stock Exchange. In one day at the central office there were 50,987 calls, an average of seven and one-fourth calls to each subscriber; but one man called sixty-eight times, and one man received 131 calls. For these heavy cases two batteries are necessary. The heaviest customer in the summer was the Fall River line of steamers. He was asked as to the increased cost to the company for each subscriber, and said that the cost increased in geometrical progression. "For instance," said he "if there were but two, it would be nothing; but if there were four it would be four times as much." This reply moved the committee to merriment, and the witness, also smiling, explained his meaning. "The company has," he said, "102 miles of poles in this city, and if they had to put the wires underground they would need 200 miles of conduit. In case of severe storms the company sometimes had 2,000 complaints in one day."

"Do you go crazy on such occasions?"

"No," interposed Mr. Camp, "we pay $91,000, as we did on one occasion, to straighten things out."

The witness explained also that the electric light wires were a source of tribulation to the telephone company.

"Did you ever hear complaints from subscribers that your rates were too high?"

"No, sir; I don't remember any case of that kind; the newspapers have talked about it."

"Do you have a press rate different from the usual rate?"

"No, sir; we charge them the full tariff."

"Have you had any application from any of them for a reduction of rate?"

"No; they are so liberal that I don't think they would want a less rate than any others."

"Does your company pay its directors for their service?"

"Only for meetings—$10 a meeting—four times a year."

"Do you have any free list?"

"I have only a list of eleven that do not pay—people with whom we are connected and as a matter of courtesy. To the Electric Club, for instance, and one of the Subway Commissioners in Brooklyn."

"Have you the list of all these?"

"Yes, but I will not give it unless you think it necessary for your investigation; others might wish for it. Then we have about a hundred of what I call deadhead telephones—officers of the company who use the instrument for the company's business solely. I have one in my house, for instance."

"What proportion of instruments do you get from the Bell Company without paying any rent?"

"About three per cent."

The Telephone in Canada.

The rapidity with which Canadian citizens adopt new and useful inventions is illustrated by the following comparative statement of the number of subscribers to telephones in Montreal, Toronto and Hamilton as compared with other cities of larger populations:

Cities.	Pop.	No. of subs.	Rates.
Baltimore	333,000	1,965	$ 80
Boston	594,000	2,450	120
Cincinnati	285,000	2,714	100
Cleveland	161,000	1,886	72
New Orleans	216,000	1,148	96
Pittsburgh	249,379	1,727	100
Detroit	116,000	2,363	72
Paris	2,226,000	4,500	120
Montreal	200,000	2,000	50
Toronto	100,000	1,900	50
Hamilton	43,000	760	37

From the above it will be seen that Montreal, with a population of 200,000—or less than one-tenth the population of Paris—has almost half as many telephones, with the prospect, as soon as the new company gets into operation, of a largely increased number. In Montreal there is one telephone to every 200 inhabitants; in Toronto one to every fifty-three; in Hamilton one to every fifty-seven; and in Paris one to every 4,946. If, as claimed by post-office and other statisticians, letter writing and electric messages are to be taken as an evidence of civilization and advanced education, Hamilton, Toronto and Montreal may count themselves as cities high up in the educational scale.

The Telephone and the Stammerer.

Young man (to druggist): Wha-wha-what are you-your ra-ra-rates for t-t-talking through you-your t-telephone?

Druggist: Fifteen cents for five minutes, but I'll give you fifteen minutes. I'm a fair man.—*N. Y. Sun.*

A Dallas, Texas, inventor has an electric fish line which kills a fish the instant it seizes the hook, and at the same time rings a bell on shore. But it does not tell the weight of the fish, and until it does electricity still has something to achieve.

WESTERN TELEPHONE NEWS.

The infringing telephone companies operating in Kansas and Missouri have been thrown into a "state" lately by reason of each having been visited by a representative of the Bell company, when the alternatives were presented of closing or standing suit for infringement and damages in the Federal Court. When it was finally realized that the Bell Company was really in earnest and prepared to enforce its rights, the wise ones bowed to the inevitable, and agreed to quit. Mr. Knight, who represents the Bell Company in this territory, states that the amount of ignorance which prevails in this latitude concerning the telephone litigation and its results is simply astounding. The number of people who think a "Bell telphone" is so named because there is a bell attached, is legion; although it is a mystery how they reconcile this conjecture with the fact that every telephone apparatus is hardly complete without such an appendix. A number, however, would "recognize a 'Pan' instrument anywhere," not by "the green cotton umbrella" it carries under its "arrum," but by the tin "amplifier" on the transmitter, which appears enough like a culinary implement to justify such a wild guess.

The Inter-State Electric Company, which is backed by ample capital, and at the head of which is our old friend Paul W. Basant, seems to have its hands full, prospectively, of storage battery business. The company was organized with a special view to explaining the electrical accumulator of the New York corporation, and a number of contracts have already been closed for isolated and station lighting in Kansas. The popularity of this method of supplying energy seems assured in this locality. The Inter-State Company have attractive quarters, and are giving a very pretty exhibition of the capabilities of the storage battery, for lighting and motor work.

The ubiquitous Col. Beetle beamed pleasantly on his Kansas City friends a short time since, not quite so young, perhaps, as he was before death created havoc in his home, but bright, cheery and companionable as of old.

The telephone service in Kansas City has been getting a rap or two of late The complaints do not seem to be justified by the facts, as the service is pronounced satisfactory by those who understand how to approach the animal. The truth is, that half the complaints in our large exchange are founded on ignorance of how to manipulate the instrument. Add to this that the average subscriber, instead of noting the time of day at which he wishes he were dead, or could reach the girl, and promptly apprizing the proper person, so that this person may apply the necessary remedy, flies to a newspaper and pours out his grievances. If this same "Suffering Subscriber" should dispose of a side of bacon which had become a trifle too ripe, to one of his patrons, and the patron, without first offering an opportunity to substitute a more acceptable article, should advertise in a newspaper the fact that "Suffering Subscriber" dealt in stinking bacon, wouldn't there be a to do? The analogy is striking. Willie Smith draws the line at "reforming" some things, but he will be found on hand when it is a question of rendering good service. WALES.

Kansas City, Dec. 5, 1887.

.... The combined horse power of the Edison Electric Light Company, in its new building in this city, will be 3,600.

.... An automatic postal telegraph company proposes to build copper wires from Boston to San Francisco, when, it is said by its projectors, it will be able successfully to compete with the Western Union.

.... Chief Walker, of the Electrical Bureau, Philadelphia, will soon place ten new fire-alarm boxes along Chestnut and Market streets, between Second and Thirteenth streets. A key is not required to strike an alarm with these boxes, as this can be done by turning the knob on the door of the box and pulling down a hook on the inside. In order to prevent false alarms the mechanism is such that when the door shall be opened a gong will be rung that can be heard a distance of two squares.

Government Telegraphy.

It was in testimony before the Post Office Committee of the United States Senate, in the postal telegraph inquiry, that while the individually owned and managed telegraph companies in the United States continuously improved in service, the tendency of Government management of the telegraph in Europe was to stagnate and retrograde; that the average of the time of transmission over the Western Union Company's lines was shorter than on any system or in any country in Europe; that the number of errors made by American operators was much smaller than those made by the European Government operators; that the progress of a single telegraph company in this country for ten years showed a growth in length of lines four times greater than that of the British postal telegraph system, five times greater in length of wire, and twice greater in additional offices; that the telegraph in the United States more than kept pace with the demand for its use and the increasing exaction of prompt transmission.

The *N. Y. Sun* says that in face of these facts, may not every one of the bills to be brought before Congress "to provide greater telegraph facilities" be considered as a card in the game of politics, each played to secure re-election to the Senate, or the House, or the Presidency?

It was in testimony before that Senate committee that an American traveling in Europe rarely receives a telegraph message that does not contain an error, requiring Yankee guessing to determine the word intended; whereas in this country complaints of errors and accidents do not average one for every five thousand messages sent—not the fiftieth part of one per cent. It was also in testimony before that committee, as evidence of the blundering uncertainty of Government telegraphy, that a writer recently filled ten pages of *Blackwood's Magazine* with samples of errors on the European lines that had come under his personal observation. It was also in testimony that no Government in Europe holds itself responsible for errors in its telegraphy; that the sufferers there are absolutely without remedy. On the other hand, it was testified that there is not a telegraph company in the United States which does not acknowledge and meet responsibility for delays and errors of transmission. Can it be possible that the American people will let half a dozen political speculators destroy their present admirable system of telegraphy, and fasten on them, in lieu of it, the lame, lazy, blundering Government telegraph of the European model, under the false pretense that the people can use it for next to nothing.

It was in testimony before that Senate committee that the British postal telegraph handled that year about 300,000,000 press words, at a charge of about fifteen cents per hundred, while the Western Union in this country handled about 800,000,000 at a charge of six and a half cents per hundred. Also, that the Western Union Company sends these press messages all over the United States at cost, and less than cost, trusting to get profitable telegraph business from the information they diffuse; that a message of ten words, excluding address and signature, can be sent from Halifax in Nova Scotia across Washington Territory to Tacoma on the Pacific coast, a distance of over 4,500 miles, for one dollar; that the average cost of messages in this country is twenty-three cents, while in Europe it is thirty-one cents; that the average time for transmitting a message from the New York Produce Exchange to the Chicago Exchange, about a thousand miles, is a small fraction of a minute, and over six hundred messages are sent a day; that the average time of a message to that city from the New York Stock Exchange is but little over sixty seconds; that as far back as June, 1883, in three successive days, of messages differing in length sent from the New York Produce Board to Chicago, 325 averaged thirty seconds in transmission, 238 averaged thirty-two seconds, and 975 averaged ninety seconds, and this wonderful time has since been shortened; that the average time of a message between New York and London is much quicker than between London and Paris, which are only 200 miles apart. On the other hand, it was testified that in the land of the dull, deliberate, and irresponsible Government telegraph, an American doing business over the wires just goes wild over a condition of things in which the time of ordinary commercial messages in the busy hours of the day, between Paris and London, exclusive of the time of delivery, is two hours! The same exasperating waste obtains in all of London's telegraphy with Antwerp and Brussels. Between London and Hamburg the time is an hour. An examination by an American of one week's business of European Government telegraphy, taken at random from night and day messages, yielded the following results, the time in every case being the difference between the filing on the Continent and the receipt on the instrument in London: 23 messages from Rome, 850 miles, average two hours and forty-three minutes; 13 messages from St. Petersburg, 1,160 miles, average one hour and fifty minutes; 12 messages from Vienna, 750 miles, average one hour and forty-six minutes; 30 messages from Berlin, 560 miles, average one hour and seven minutes; 58 messages from Paris, 200 miles, average one hour and ten minutes. A few telegrams from Constantinople, 1,480 miles distant, averaged four hours each! A few from Madrid, in Spain, 750 miles from London, were anywhere from one hour to five hours on their royal way.

"We can positively assure any presidential candidates in the United States Senate who are working the postal telegraph pull, that the Americans don't want and won't have any such tortoise institution as that. We want lightning, and lightning speed, and lightning brains, and we want responsibility, and don't want any Court of Claims at the tails of our telegrams. We will stand no such ramshackle machine as is exhibited in the above figures, nor will we permit to be transplanted into our energetic commercial and social life that feature of the absolute and constitutional monarchies of Europe which secures espionage of the correspondence of the people, and burdens their business with the dullness and slowness of imperial forms. Government in the United States was not established for such postal telegraphy, nor for any postal telegraphy whatever. It was established for the protection of life, liberty, and property, and for nothing else. The Declaration of Independence and the Constitution, which are our fundamental law, make our Government a protector, not a guardian. The people don't want guardianship. They can attend to their own telegraphing. And they demand of the politicians who are endeavoring to pervert the functions of the Government, to keep hands off of their affairs."

Possible Uses for the Phonograph.

In all that has been written about the uses to which the forthcoming Edison practical phonograph (and the Eastern press are now giving the subject much attention), nothing has been said of the facilities that it will give people who can neither read nor write for correspondence. Indeed, there is no doubt but there will be an immense demand on the wonderful powers of the instrument from this class. The instruments into which books have been read will also repeat them to the blind, and those thus afflicted can have the choicest treasures of the libraries of the world at their service day or night.

The invalid, too, whose friends are away, or busy, or asleep, can have his faithful reader always at command. But all these things are not pertinent to this "Railway World." The thought that suggested the paragraph is this: What a valuable thing a phonograph would be on a rapidly moving train during a long journey. It is hard on the eyes of many to read in traveling, or at night the light is insufficient, or the car is darkened for sleeping. The restless passenger may have his faithful phonograph in his berth, and with the earphone adjusted can listen to its sweet voice, at will, without disturbing anybody. Then, too, all know the difficulty of writing on a train. This will now be overcome. Not only for business correspondence may it be used, but an author's best thoughts often come to him amid the waits or among the inspiring scenes of a long journey. These may be faithfully recorded.—*Cincinnati Commercial Gazette.*

New Work for Messenger Boys.

I met a messenger boy the other day, says a Boston writer, lugging a big-eyed and very much astonished baby, evidently not a family connection of his, which, on questioning the boy, I learned he was to deliver at a certain house not far distant. For him this was all in the regular line of his business, and he went about it in a solemnly practical way that was quite admirable. I do not think he loitered with this burden on his hands. As for the parent who entrusted the baby to this method of carriage, he or she must have a confidence in the security of the messenger service that is nothing less than heroic. Yet I do not doubt that the baby got there safe.

An interesting manual upon the "Commercial Development of Electric Lighting in this Country" has recently been issued by the Maverick National Bank of Boston, of which Mr. Asa P. Potter is President. The book is interesting and instructive reading for some of the eminent bankers and financiers of the United States, who, from their lamentable ignorance of the subject, have improved every opportunity to discredit electric lighting as a legitimate business enterprise. Mr. Potter is one of the most progressive and successful bankers in this country, and his opinion upon this or any other financial subject is worthy of the most respectful consideration.—*Daily Graphic.*

Testing the Lad's Honesty.

A lawyer engaged a new boy recently, and, as he had suffered to some extent from the depredations of his former lad, he determined to try the new boy's honesty at once. He therefore placed a five-pound note under a weight on his desk, and walked out without a word. Upon his return, half an hour later, the note was gone and half a crown in silver had taken its place.

"Boy when I went out I left five pounds under this weight."

"Yes, sir; but, you see, you hadn't been gone five minutes when a man came in with a bill against you for four pounds seventeen and sixpence. I believe the change is correct."

"You paid a bill?"

"Yes, sir; there it is, all receipted. The man said it had slipped your mind for the past four years, and so—" That boy is looking for another job.

Disaster to a Great Copper Mine.

A dispatch from Detroit contains the following: Great excitement was caused at Calumet at noon to-day when the ground about the main engine shaft of the big Calumet and Hecla copper mine caved in and immense volumes of smoke poured through the fissure, which was fully twenty feet wide. As soon as it was seen that the mine had caved in, the ground between the engine shaft and the No. 1 Hecla shaft began to settle, and in a few minutes was twelve to fifteen feet out of place. It made dangerous work for the men, who were totally unable to cover the openings sufficient to stop the newly formed vent which the long-continued fire in the mine has made disastrous, and there are fears that a serious crisis has been reached in the history of the Calumet and Hecla mine.

The supporting timbers in the mine are all on fire, making a subterranean forest fire of immense proportions. There have been no fatalities at the mine since the cave-in, but the miners are working in great danger. If the supports to the mine, which are all of timber, should be destroyed, there is danger that the entire mine will be destroyed.

Already the fire has caused a loss of many thousands of dollars and a long stoppage of work, as the smoke has been so thick in other parts of the mine as to preclude all possibility of getting out ore. This new feature, it is feared, will cause the fire to be drawn to all parts of the mine.

.... Three Western Union linemen were fined $10 each last week in Philadelphia for putting up telegraph poles.

TELEGRAPHIC

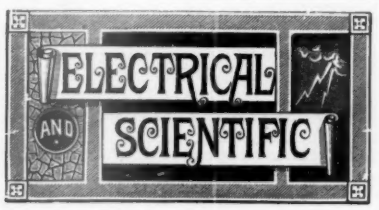
.... The poles which the Western Union Company had erected on Bridge avenue, Camden, N. J., Dec. 10, without authority, and which were ordered removed, were taken down last week.

.... The negotiations between England and France contemplating the joint working by the two governments of a telegraph system across the British channel, promises to conclude amicably and satisfactorily to both parties. France has joined England in refusing to renew the present concessions enjoyed by the Submarine Telegraph Company, and the latter being thus completely shut out will be obliged to sell its wires, etc., upon the terms set by England. The British government is disposed to reduce the rate by the submarine lines to two pence a word, and with this rate France is believed to be satisfied.

.... Mr. F. C. Mason, Superintendent of police telegraphs, Brooklyn, has recently obtained a Mexican remedy for rheumatism which has effected some remarkable cures. The remedy was discovered by his brother, B. D. Mason, United States deputy surveyor of Fairview, New Mexico, during a visit to Mexico several years ago. Among the remarkable cures effected is that of Mr Frank O Clark, of 415 Fulton street, Brooklyn. Several telegraphic friends of Superintendent Mason, who have suffered with rheumatism and neuralgia, endorse it highly. A depot of distribution has been opened at 19 Park place, New York. Any one suffering from rheumatism will receive a bottle by mail free of charge, by sending their address to the Ideal Medicine Co. at that address.

.... The talk of a new telegraph line between New York and San Francisco has aroused the old timers in New York to lively reminiscences of the building of the first line across the plains. One pole, 100 miles west of Laramie, was set up four times and each time hacked down by Indian tomahawks. Each time there was a bloody skirmish with the redskins for temporary possession of the stump. At last the pole was given to a young man who is now high up in the management of the Western Union. He laid a mine in the hole, set up the new pole, trailed the fuse to an ambush of rocks close by and waited with two armed friends. Then a band of eight Sioux came along and held a war dance around the pole. When the mine was fired all but three were killed and those three carried off Minie balls with them. The powder blew up the pole again, but it cleaned the hole out nicely for a new one, which was thereafter let alone. This story was told with great eclat at Delmonico's, and was the signal for more bottles and more stories. It is curious what enthusiastic story tellers are to be found among New Yorkers who have seen life in the Rockies.

.... There is a strong sentiment growing among the barbed wire manufacturers of Joliet, Ill., which is shared by some of the manufacturers in St. Louis and other western cities, against paying the royalty to Washburn & Moen, of Worcester, Mass., while so many unlicensed firms are allowed to run and pay no royalty. Judge Treat's decision at St. Louis about two years ago was adverse to the validity of the Washburn & Moen patents, and since that time a great many "moonshining" establishments have sprung up throughout the district coming under the judge's jurisdiction. Washburn & Moen are understood to be pressing the unlicensed firms in the higher courts, but the manufacturers here are growing restless. One of the most prominent among them said that it was the intention to form a pool and contest the validity of the patent. If the matter culminates, the Joliet manufacturers will be joined by the licensed firms in St. Louis, and they will spend the money in law that they now pay Washburn & Moen as royalty. It is further claimed that this move is a necessity, or the licensed mills will have to shut down as they cannot compete with those who do not have to pay the royalty.



* * An electric railway company has been organized at Little Rock, Ark. Howard Adams is president. Others interested are John B. Jones and M. W. Benjamin.

* * The Minneapolis (Minn.) Electro Matrix Company has been incorporated, with a capital of $1,000,000. The machine controlled by this company is a matrix-making machine, and it is claimed that one man with it can supplant five men setting type.

* * The new uses to which electricity is being put are too numerous to mention. The ingenious Dr. Milton Joseph Roberts, of this city, has invented apparatus with which he removes wens, moles and other excrescences from the human form divine, and, says an exchange, we should not be in the least surprised to learn that somebody had so far improved on the original invention as to make it possible to remove birthmarks with it.

* * Saturday evening next the buildings and streets in Jerseyville, Ill., will be illuminated with Edison's incandescent electric lights. About sixty lights will be distributed in the streets, aggregating some 2,000 candle power. The trains from Alton to Jacksonville and from Springfield to the river running through this place, will run so as to accommodate visitors that evening who desire to witness the illumination.

* * The Board of Commissioners of Red Bank, N. J., awarded a contract to the Red Bank Electric Illuminating Company to light the town by electric lights. The price agreed upon was $1,300 a year, for three years. At present the town is paying about $200 less than this for gas, but it is thought that the additional light received will more than pay for the difference in cost. The lights will be 2,000 candle power each, and there will be twenty-five of them.

* * The curious fact that the usual heat produced by friction is absent when the articles are magnetized is just now being discussed by scientists who are seeking an explanation. Very striking examples are described in a late number of a scientific periodical. A workman fastened a couple of powerful magnets to his lathe to hold more securely a piece of metal which he wished to drill and turn. The presence of the magnets kept the metal so cold that no water was needed to keep the drill moist and cool. This unusual circumstance may lead to important mechanical advantages. It is such circumstances as the one noted above that lead to valuable discoveries. The scientists who are looking for a reason why the heat should be absent may not hit upon any valuable idea, but some practical mechanic probably will.

* * During the past week many scientists and manufacturers have been attracted to the shops of the John T. Noye manufacturing company, on Lakeview avenue, Buffalo. The works are well worth visiting at any time, but just now the attraction is Prof. Elihu Thomson's electric welding machine, which has been described before in these columns. The welding machine, now exhibited in Buffalo for the first time, rests on a wooden pedestal about a foot and a half square. It is manipulated with great dexterity and ease by Mr. Fish, a graduate of the Institute of Technology, in Boston. The leading principle of the art of electric welding, briefly stated, is that a sufficiently heavy current of electricity passing through any electric conductor generates heat in the conductor, the most heat at the point of the greatest resistance, which heat is used to soften, fuse and unite the parts of metal which have been pressed together. The machine exhibited in Buffalo is a small one, capable of welding pieces between one-sixteenth of an inch and a half inch. Brass, copper, tin, zinc, and even aluminum, can be operated on. Many combinations, such as brass and iron or cast steel and iron, can also be united.

The Requirements of a Course of Electrical Engineering.

To the Editor of Electrical Review:

In your issue of November 26th, Mr. F. R. Hutton, in an ably written essay upon "What are the Requirements for a Course in Electrical Engineering at a Technical School?" made some statements and reached some conclusions with which I cannot altogether agree. And, if your valuable space will permit, I should like the opportunity to briefly discuss some of the points brought up in that paper.

In the first place, Mr. Hutton holds that a student in electrical engineering should be taught, while in college, merely "principles and how to study;" and that the "narrow and more material view" is that "the education should not only furnish knowledge, but experience also," because many men, on entrance into school, have not become differentiated or specialized enough for them to decide upon which side of the dividing hedge in the field of engineering their special work will lie.

Now, if we are to judge of what special qualifications are most needed to make a successful engineer in any branch of engineering whatever, by examining the most notable mental endowments of the now successfu engineers, I believe that we should find a well-trained judgment to be of prominent importance. This, too, will be the most evident in those branches of engineering where there is no complete set of well-established rules to guide those working in them.

The rules governing the practical application of electricity to the needs and comforts of man are yet very tentative, and unfortunate is he who is obliged to launch out into life as a "leader" in some branch of electrical engineering, who brings to the work only the knowledge of the principles of the science, and an ability to study up the case from that which has been published on the subject.

For in all branches of electrical engineering there constantly arise difficulties that he whose only knowledge of the subject has been derived from the books, would never have anticipated, because, from the nature of the case, nothing has been written concerning them. The only preparation that can be obtained for such cases must come from a practical familiarity with the working of electrical apparatus and devices.

The different branches of electrical engineering are not so independent of each other but that a general course of experiments with physical apparatus will be quite sure to make the student feel familiar with almost any branch of the subject that it may be his lot to undertake after graduating. But without such a training of his judgment his success in surmounting the difficulties that are sure to come up in the practical application of the science is certainly not assured.

Then, too, Mr. Hutton holds that because the students cannot in most cases decide before entering the technical school, as to what branch of the work he will be most likely to follow after graduating, the acquaintance with the applied science that he may obtain while in the school may be wide of the object to which he is afterward obliged to give his attention.

As Mr. Hutton himself points out that the field of the electrical engineer is necessarily very limited, little argument should be necessary to convince him, at least, that the several branches of electrical engineering are so closely allied that it would be quite impossible for one to successfully complete a general course of electrical experiments without obtaining information that would directly apply to almost any case that would come up in his practice of the profession. At any rate, the familiarity with the work which he would obtain in such a course would be of invaluable assistance to him, although the subject that he may be obliged to undertake be quite different from anything with which his college work made him familiar.

Again, Mr. Hutton claims that "the course of study in any branch of engineering should make its graduate competent to become a teacher in that work which he has to do." By which is meant, I suppose, that the requirements for graduation should be so fixed that none who did not possess exceptional qualifications for the work could graduate in the course.

I believe that the more reasonable way of regarding this part of the subject is that the requirements for graduation should be so fixed that of those who would be likely to undertake the work, he of average ability might, by diligent work, complete the course in the prescribed time. For by no means all of those who might, with profit to themselves and the work, undertake such a course, are naturally fitted to become "leaders" in their profession. And those who are able to become "leaders" can avail themselves of the opportunity for advanced work which should be provided in connection with all such courses.

With such an arrangement those who were fitted to become "leaders" would find able assistance in those graduates of lesser ability.

Mr. Hutton lays special stress on the necessity of an electrical engineer being first a mechanical engineer, and finally closes the article with the conclusion that it were better to have an "electrical engineering attachment to the mechanical engineering courses of our universities and technical schools:" that is, make the mechanical and electrical courses one.

It should not require much proof to convince those at all acquainted with the subject, that a thorough knowledge of mechanical engineering is necessary to an electrical engineer.

But with equal truth it may be said that the mining engineer must also be a civil engineer, and the physicist also a mathematician. Yet those who have arranged for the technical courses of our schools of advanced learning, have not, it seems, thought it wise to compel all those who desire to graduate in civil engineering to study mining engineering also, nor those who desire to graduate in mathematics to also make a specialty of physics.

Neither does there seem to be any sufficient reason for obliging those who desire to become mechanical engineers to make a special study of electrical engineering.

If the electrical engineering attachment were applied to the mechanical engineering courses as they are now constituted, at least one year more would be required to complete such a course.

But by leaving mechanical engineering a separate course, and by making the electrical engineering course coincide with it for the first three years, and distinct for the last year, as is done in Cornell University, for instance, the work of each course is accomplished in four years. Then, if the student desires to continue the work in college after graduating, post-graduate courses are provided.

DAVID E. LAIN.

The Burton Electric Heater in Railway Cars.

To the Editor of Electrical Review:

A series of highly interesting and encouraging tests have been made here, at the plant of the Electric Railway Company, with Dr. Burton's electric heaters. Last evening we boiled water and cooked eggs as nicely as could be done on a cooking range. We used three heaters, connected in series, and, from the results obtained, Lieut. Greene, electrician of the Sprague and Edison Companies, is confident the system may be applied to the warming of electric cars, to the greatest advantage and comfort, with a current of not more than one and a half amperes. He even goes farther in expressing the opinion that it may be applied to steam railway cars as well. But no doubt the first practical application will be made on the cars of the Union Passenger Electric Railway Company, of Richmond.

M. T.

Richmond, Va., Dec. 9, 1887.

* * The Daft people announce that they will soon give another trial of their motor on the Ninth avenue elevated, New York city.

Starting Mitchell, Vance & Co., Again.

The company which Charles L. Mitchell, of New Haven, and those associated with him have formed to continue the business of the late firm of Mitchell, Vance & Co., engaged in the manufacture of gas and electric fixtures, bronze ornaments and the like, for which Thomas F. Gilroy was appointed receiver, has received the sanction of over 95 per cent. of the creditors, which practically insures the success of the undertaking.

The plan of Mr. Mitchell upon which the new company is being formed contemplates the settlement of 50 per cent. of the claims of the creditors, of which about one-third will be paid in cash. The balance will be secured by the notes of the new company payable in six, twelve, eighteen and twenty-four months. These notes are to be secured by a mortgage upon the property, real and personal, of the late corporation. If the creditors choose they can have stock in the new company in place of notes or cash. The stock of goods in the hands of the receiver is being closed out as rapidly as possible and at large deductions from usual prices, in order to prepare for the first cash payment to creditors, which will require about $200,000.

The cash capital at which the new corporation will begin business is stated to be $125,000. At present only enough men are employed in the large factories by the receiver to keep the machinery and tools from rusting. When the new company takes hold it is expected that a full force of workmen will be required, and that the manufacturing of brasswork will be started again on an extensive scale. We wish them success.

—— York, Pa., is to be lighted by electricity.

—— Johnstown, N. Y., is to have the electric light.

—— Ft. Edward, N. Y., is to be illuminated by electricity.

—— An electric light plant is to be established at Anna, Tenn.

—— Big Rapids, Mich., is determined to be worthy of its name and is arranging to have an electric light plant.

—— The Birmingham, Ala., Safe and Lock Co. will erect an electric light plant in connection with their works at East Avondale.

—— Medina, N. Y., will have electric lights in running order by February 1. It will take 40 lights at a cost of $62.50 per light a year.

—— The Western Electric Light Co., of St. Louis, Mo., has been incorporated; capital stock, $60,000. F. L. Johnson and others, incorporators.

—— The city of Hagerstown, Ind., is agitating the question of electric lights, and several plans have already been laid before the city council.

—— The Lewisburg Electric Light Company, Lewisburg, Pa., has been incorporated. Capital stock, $15,000; Cyrus Hall, George S. Matlock, and others are incorporators.

—— The Roodhouse Electric and Power Co., of Roodhouse, Ill., has been incorporated; capital stock, $5,000. Ellis Briggs, Frank M. Bateman, and others, incorporators.

—— The Thomson-Houston Electric Light Company, of Baltimore City, Md., has been incorporated. Capital stock, $200,000. S. H. Taggart, G. R. Berry, and others, incorporators.

—— The United States Automatic Electric Protector Company, of Camden, Pa., has been incorporated. Capital stock, $150,000. Thomas A. D. Forster, Samuel P. Hanson, Norristown, Pa, and others, incorporators.

—— At Ashland Ky., an electric light company has been organized with E. M. Roberts, president; capital, $10,000. A Waterhouse system, 30 light, full arc, for city lighting, and 30 light, full arc, 1,200 candle power, for commercial lighting, have been contracted for.

Friction Driving Gear for Dynamos.

We illustrate herewith two fine sets of electric light machinery, constructed by the Anglo-American Brush Electric Light Corporation, Limited, of London, under the patents of Mr. J. S. Raworth, their superintending engineer. The dynamos are of the Victoria Brush type, and are driven by friction gear, after a manner which has been successfully adopted in nearly two hundred large installations. The essential feature of this gear is that the dynamo is hung in a cradle, which permits it to respond to the action of the screw which puts the grip on the friction wheels, without putting any extra pressure on the bearings of the armature spindle. The friction pinion is made of compressed paper and runs in contact with a large cast-iron wheel, which also acts as the fly wheel of the engine. The pressure between the two surfaces is obtained by screwed rods, seen at the left hand of the figures. These rods connect two gun-metal bearings, which are applied to extensions of the crank shaft and of the armature spindle. Thus the strains due to the pressure between the frictional surfaces are practically confined to the two exterior bearings, and as these are not connected to the framework of either engine or dynamo, their wear does not throw other bearings out of line.

The engine in the upper block has a cylinder 8 inches in diameter by 8 inch stroke. The valve chest is at the back of the cylinder, and the valve is worked through a rocking shaft, this arrangement allowing the engine and dynamo to be included within a length of 5 feet 6 inches, and thus rendering it applicable in very confined spaces.

The engine shown in the lower block is of Raworth's compound high-speed type. It has cylinders 7 inches and 12 inches in diameter by 8 inch stroke, working on two cranks set 180 degrees apart, so that the pistons and connecting rods balance each other. There is a single bearing between the two cranks, the second bearing of the shaft being at a considerable distance, close to the fly wheel. As the two cylinders balance each other, the stresses on the cranks are equal, and consequently there is but little friction on the intermediate bearing, the engine running very light in consequence. The low-pressure valve chest is seen in front, that of the high-pressure cylinder being behind the governor.

These two sets of electric lighting machinery were exhibited at Manchester and attracted a large amount of attention. They are designed to feed 140 and 300 lamps respectively, and are specially distinguished by their compactness and lightness. On shipboard they have been very successful, and have met with the warm approval of seagoing engineers, who find some of the high-speed engines difficult to understand and impossible to keep in satisfactory order. The engines work with a small expenditure of fuel, and are provided with ample bearing surfaces and the most perfect lubricating appliances, so that they can run for days together without a stop, either for oiling or for setting up the brasses. In land installations, particularly those in London clubs and hotels, the small space occupied by this plant often renders it possible to introduce electric light when otherwise it would be inadmissible, while the directions of the motion and its high efficiency secures for it the approval of those who delight in a neat and workmanlike piece of machinery.

We are indebted to our esteemed contemporary, *Industries*, of London, for cuts and description above.

—— Mr. C. J. Cline, an electrician from Boston, who is in Rutland, Vt., looking over the electric light plant with a view to enlarging its capacity, says that this is one of the best arranged stations he has ever seen outside the large cities, but in order to carry out the plans of the company their present building will have to be enlarged and a wing added, with the addition of a 100 horse power boiler and 125 horse power engine. With these increased facilities the company will be able to double their present power and to run about 1,200 incandescent and 120 arc lights.

—— W. H. Davis is interested in an electric light plant to be established at Oxford, N. C.

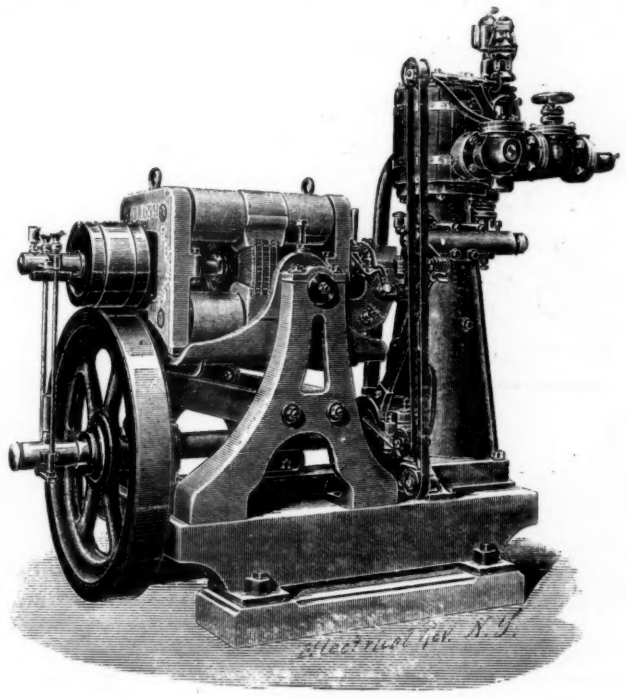
—— Elmer E Wood, Manager of the Canandaigua Electric Light Company, Canandaigua, N. Y., was killed by an electric shock in that village last week. He started to go home, but noticing that an electric lamp on the street did not burn clearly, he attempted to fix the carbon in it. His kid glove was wet, and coming in contact with the wire, he received a terrible shock. He was heard to groan, and then dropped unconscious to the ground. He was picked up a moment later and breathed his last. The only mark on him was a small and black hole in his thumb.

—— A. T. Grady will establish an electric light plant at Goldsboro, N. C.

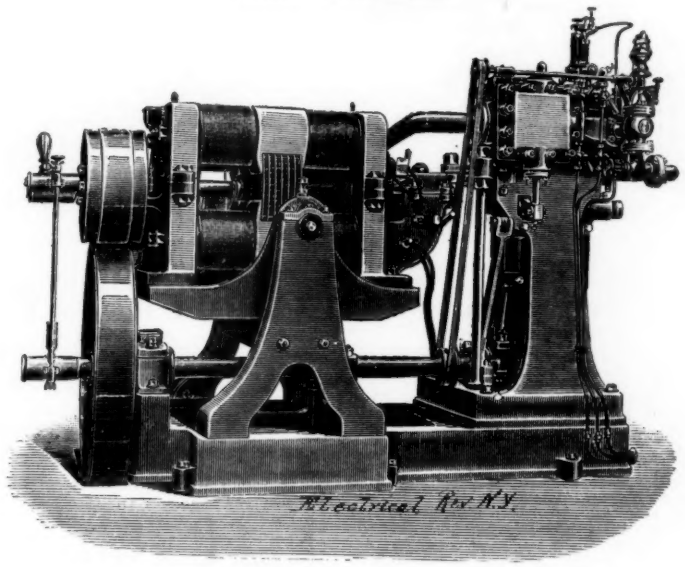
—— The Buffalo council has ordered a number of additional arc lights for city lighting.

—— The Weston Electric Light Company, St. Louis, Mo., has been incorporated. Capital stock, $60,000. F. L. Johnson and others incorporators.

—— Mr. C. J. Field, formerly with Mr. J. H. Vail, at 16 Broad street, New York, has accepted the position of chief engineer of the Edison United Manufacturing Company, 65 Fifth avenue. Mr. Field is a capable mechanical engineer, a graduate of Stevens Institute, and is a valuable addition to Vice-President Chinnock's staff.



Victoria Brush Dynamo.



Friction Driving Gear Dynamos.

Electric Light at Pullman, Ill.

The Pullman Palace Car Company has been busy for the past two months establishing a system of electric lights, by which all of the various departments could be lighted sufficiently to allow the workmen to work at night as well as in the daytime. The system has just been completed and is one of the largest and most complete electric plants in the country. The immense dynamo, Edison patent, is located on the second floor of the water tower, and has a capacity of 1,000 incandescent lights, all of which are now in full blast every afternoon after 4 o'clock. Wires radiate from the tower to every department of work in Pullman. There are also 80 Ball electric lights, and a smaller dynamo in the new upholstery department furnishes upward of 50 electric lights for that department, used only when the large dynamo is not in working order. The entire system is pronounced one of the most complete in operation anywhere near Chicago, and the workmen at Pullman are in high glee over the substitution of the electric lights for the gas and oil lamps.

—— The Roodhouse Electric and Power Company, Roodhouse, Ill., has been incorporated. Capital stock, $5,000. Ellis Briggs and others, incorporators.

—— The Presque Isle Electric Light Co., Presque Isle., Me., has been incorporated. Capital stock, $10,000. James W. Bolton and others, incorporators.

—— A new invention for the propelling of street cars is in the application of the gas engine to a moving train car. All such attempts have failed heretofore, for the reason that the gas engine starts and stops too slowly. In this case the engine will be in motion continuously, and the power will be thrown off and on, as the occasion may require, by the use of movable friction wheels geared on an endless link belt. This belt is to be attached to the engine. Ordinary illuminating gas will be used.

ELECTRIC LIGHT NEWS

—— San Angelo, Texas, is to have an electric light plant.

—— Carlinville, Ill., is to have an electric light plant, with a capacity of fifty arc lights of 2,000 candle power.

—— Thomson-Houston Electric Light Company, of St. Paul, has a franchise to put in a plant at Hastings, Minn.

—— At Oakland, Me., the subject of lighting the streets by electricity is at present engaging the attention of the citizens.

—— It is reported that a stock company has been formed at Leicester, Mass., to introduce electric lights into several of the many factories.

—— A consolidation of the electric light companies in St. Louis is proposed. The Laclede Gas Company is endeavoring to purchase an electric plant there, so as to be able to furnish both kinds of light.

—— A correspondent writes from Ft. Wayne: The Jenney Electric Light and Power Company has purchased what is known as the "Feeder Canal" for $67,000, and will utilize its water power to operate the city plant.

—— The town council at Livermore, Cal., has granted to Thomas Varney, president of the Bank of Livermore, and others, a franchise for the erection of an electric light plant, and it is stated by the projectors that work will be begun within a few weeks.

—— Buffalo, N. Y., is increasing its electric lighting area. High street, from Main to Genesee, West avenue from Forest avenue to Carolina, Austin from Niagara to the Military road, and Jefferson, from Ferry to Main, are to be so lighted, and a miscellaneous lot of street corners are to be illuminated also.

—— Chas. A. Schieren & Co. report sales of leather link belting for use on dynamos, during the past week to the following parties: Wilmington City Electric Co., Wilmington, Del., 48 ft. 9″ Standard link belt, 157 ft. 10″ Standard link belt; Pawtucket Electric Light Co., Pawtucket, R. I., 49 ft. 8″ Standard link belt; Wachusett Electric Light Co., Fitchburgh, Mass., 34 ft. 8″ Standard link belt.

—— The following were elected officers of the Perfection Heat and Light Company at a meeting held at 938 F street, Washington: Colonel D. C. Ludlow, president; G. M. Filmore, secretary; and Calvert Witmer, treasurer. A board of directors was also elected as follows: G. M. Filmore, Calvert Witmer, George G. Shroeder, O. D. Green, Thomas D. McCleary, O. F. Randall, R. A. Cronin, John F. Vogt and Daniel A. Logan.

—— The men who are examining a thousand applications per week for patents, on which the industrial progress of the country is largely dependent, are jammed into small rooms, breathing foul air, and digging their elbows into one another every time they turn around. Seven examiners, two clerks, and from one to five attorneys, in a small room, soon reduce the atmosphere to an almost unbreathable condition. Desks are so crowded that when the big portfolios containing drawings are pulled out, the passage ways are entirely blocked, and there is not even room for a stool for the man who is making the search. He must either sit on the floor or on his heels. It is said that the efficiency of the present working force could be increased 20 per cent. by giving it sufficient room. These facts are beginning to be realized by Congress, and something may be done this session looking toward relief. "Ben" Butterworth, of Ohio, who was Commissioner of Patents under Arthur, always takes a benevolent interest in the welfare of the bureau, and will probably take the lead in any measure that may be proposed.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING DEC. 6, 1887.

374,173 Apparatus for converting heat energy into electrical energy; Willard E. Case, Auburn, N. Y.

374,224 Incandescent electric lamp; Marshall Wheeler, Boston, Mass.

374,225 Electrical dental engine; George W. Whitefield, Evanston, Ill.

374,236 Electric railway; Edward M. Bentley, New York, N. Y.

374,315 Conduit for cable or electric railways; William Nier, Kansas City, Mo.

374,329 Galvanic battery; Henry E. Waite, New York, N. Y.

374,348 Underground conduit for electrical conductors; George W. Cook, Detroit, Mich., assignor of one-half to Charles B. Coe, same place.

374,374 Electric governor; Willis H. Reynolds, Washington, D. C., assignor to the Columbia Electric Light and Motor Company of West Virginia.

374,381 System of electric distribution; Montgomery Waddell, New York, N. Y.

374,390 Telegraph transmitter; Arthur Bixby, Baltimore, Md., assignor to George W. Graffiin, same place.

374,404 Regulator for electric currents; Stephen D. Field, Yonkers, N. Y.

374,406 Regulation of electric generators; Daniel Higham, Philadelphia, Pa., assignor to the Higham Electric Motor Company, same place.

374,439 Transmitter; Ruel W. Whitney and Frederick Bultz, Cleveland, Ohio.

374,444 Printing telegraph; Arthur Bixby, Baltimore, Md., assignor of three-fourths to Samuel G. B. Cook, same place.

374,456 Galvanic battery; Frank J. Crouch, Eugene City, Oregon.

374,458 Underground system for electric wires, Joseph P. Davis, New York, N. Y.

374,495 Coin-operated induction coil; William R. Pope, Baltimore, Md.

374,528 Electric gas lighter; Justus B. Entz, New York, N. Y.

THE EAST RIVER ELECTRIC LIGHT CO'S STATION.

East 24th and 25th Streets and East River, seven stories and basement building, 90x196, within five minutes of center of city, light on all sides, Offers to

Manufacturers of Electrical Appliances

Desirable rooms to rent, with power, heat, elevators and electric light.

POSSESSION WHEN DESIRED.

Apply to

JOHN J. MOORE, Manager.

Room 19, Temple Court.

PATENTS.

ELECTRICAL REVIEW PATENT BUREAU

Conducts a general business in the preparation and prosecution of Applications for Patents, in the United States and all Foreign Countries. All business carefully and promptly attended to in the matter of Reissues, Caveats, Trade Marks, Labels, Design Patents, Copyrights.

SPECIAL SEARCHES made to determine the question of novelty or infringement.

ELECTRICAL PATENTS A SPECIAL FEATURE. All business receives the direct personal supervision of the Manager, whose fourteen years' experience as Patent Attorney and seven years as Practical Electrician, insures thorough and satisfactory work.

All communications are strictly confidential, and inventors may address us with entire freedom.

Our charges will always be as moderate as first-class work will permit and commensurate with the amount of work to be done.

Address,

Electrical Review Patent Bureau,

13 Park Row, N. Y. T. J. McTIGHE, Manager.

WANTED FOR CASH.

An Elliott Edelmer or Muirhead Rheostat with Shunt, Comparative Coils, Thomson Galvanometer, &c. Best and in best order. Address CRANK 701, Box 3329. New York, N. Y.

J. E. JEFFORDS & CO.

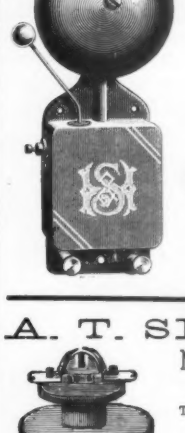
Manufacturers to the Trade.

POROUS CELLS

Of Every Description, Made to Order.

25 years' experience in this branch of the business.

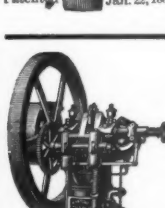
2716 to 2738 Salmon St., Philadelphia, Pa.



Bug and Dust Proof BELLS.

Hazazer & Stanley, Electrical Man'f'rs, 32 and 34 Frankfort St., NEW YORK.

A. T. SMITH'S



Patented Jan. 22, 1884

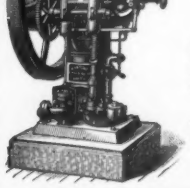
NEW PAT'D. ELECTRIC LAVA GAS TIP,

The Cheapest and Best Burner in the market

For Multiple Lighting.

Send for prices to

A. T. SMITH, 6 West 14th St., New York.



KORTING GAS ENGINE

—1 to 60 H. P.—

Most economical Engine yet offered to the public, and specially adapted for running dynamos.

Address

Korting Gas Engine Co., LIMITED.,

60 Barclay Street, N. Y.

WE GLADLY TESTIFY to the SUPERIORITY of the

MUNSON

Eagle and Dynamo Electric Light Belt.

The stretch, otherwise than the elasticity, is removed, no rivets and perfect evenness in heft, the result noiseless with a perfect motion, which is absolutely essential for a steady light. We use no other make. The character and responsibility of the house is unquestioned.

TESTIMONIALS.

Western Edison Light Co., H. WARD LEONARD, General Sup't.
W. J. Buckley, Mgr. Ft. Wayne Jenny El. Light Co.
Thomson-Houston Electric Light, Herbert Wadsworth, Manager Western Office.
Brush Electric Co., Alex. Kempt, Special Agent.
Excelsior Electric Co., C. J. Reilly, Western Mgr.
Sperry Electric Light Motor & Car Brake Co., 201 Royal Insurance Building.
J. H. Reid, General Manager of the Mather Electric Light Co., Chicago.
Wm. H. Purdey, Comm. of Public Works, Chicago.
John Mab, Chief Engin'r of Board of Trade, Chic.
C. J. Melmes, Gen'l Sup't Thomson-Houston Light, Omaha, Neb.
J. A. Corbey, St. Joe Electric Light and Power Co., St. Joe, Mo.
Wm. Oswald, Agt. Edison Light Co., New Orleans, La.

OFFICE AND FACTORY,

240 & 242 RANDOLPH ST., CHICAGO.

Detroit Electrical Works

MANUFACTURERS OF

ELECTRIC SUPPLIES,

INCLUDING

Medical Batteries, Skeleton and Box Bells, Burglar Alarms, House Annunciators, Fire Alarm Boxes, Pins, and Brackets,

INSULATED MAGNET, TELEPHONE AND ELECTRIC LIGHT WIRE.

GENERAL OFFICES and FACTORY:

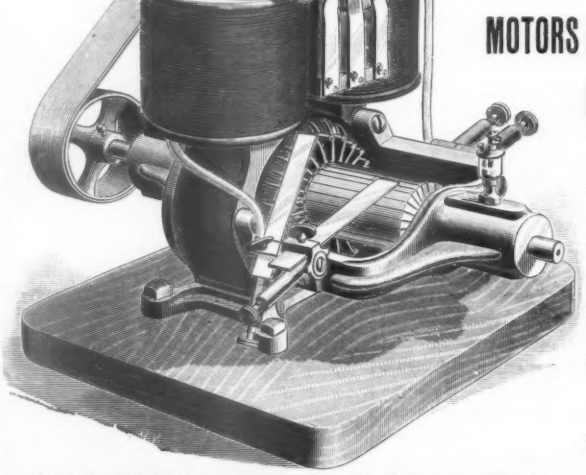
DETROIT, MICHIGAN.

SILKS, Full assortment of different sizes and qualities on BRAIDER SPOOLS, ready for the machines, in Red, Yellow and Green. Other colors to order.

SEND FOR SAMPLE AND PRICES.

WM. MACFARLANE & CO., - - 55 Mercer Street, New York.

MILL, YONKERS, N. Y.



C. & C. Electric Motor,

UTILIZING IN SMALLEST MOTORS LATEST DYNAMO IMPROVEMENTS.

Automatic Motors, or with the Wheeler Safety Regulator.

Wound for any circuit.

C. & C. ELECTRIC MOTOR CO., 88, 90 and 92 South Fifth Ave., N. Y.

The Empire City Electric Co.,

15 Dey Street, New York,

Manufacturers of

Telephone, Telegraph,

AND

ELECTRIC LIGHT SUPPLIES.

WRITE FOR PRICES.

Leclanché,

The Standard Open-Circuit Batteries of the World.

GONDA and DISQUE,

The Only Genuine Leclanché Batteries

Are those which bear this LABEL and the Trade-Mark, GONDA.

DO NOT BE IMPOSED UPON BY IMITATIONS.

If dealers have not the Genuine Battery, send direct to us for Price-List.

THE LECLANCHÉ BATTERY CO., 149 West Eighteenth Street, New York.

GONDA (FORMERLY PRIDE) CELL, COMPLETE.

GENUINE DISQUE CELL, COMPLETE. The Porous Cell also bears Label.